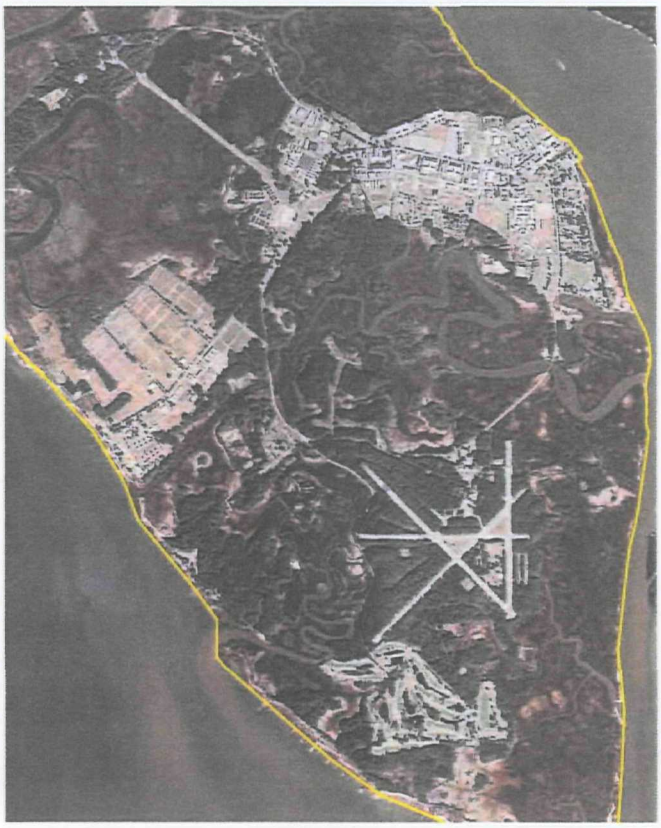
FINAL RECORD OF DECISION

SITE 3

MARINE CORPS RECRUIT DEPOT, PARRIS ISLAND, SOUTH CAROLINA

NAVFAC
Naval Facilities Engineering Command



AUGUST 2011

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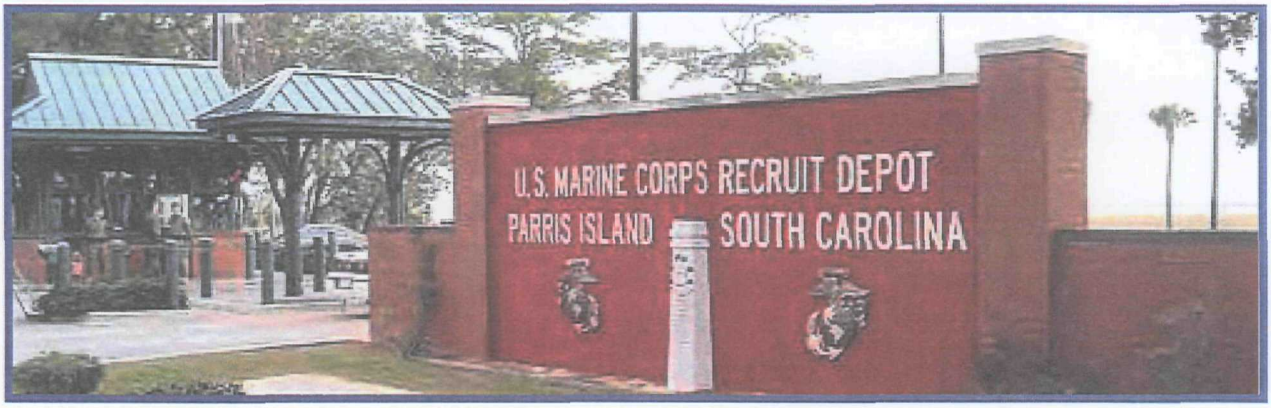


1.0 DECLARATION

1.1 SITE NAME AND LOCATION

Site 3 – Causeway Landfill at United States (U.S.) Marine Corps Recruit Depot (MCRD), Parris Island, South Carolina, United States Environmental Protection Agency (U.S. EPA) ID number SC6170022762.

1.2 STATEMENT OF BASIS AND PURPOSE

This Final Record of Decision (ROD) presents the final remedy for Site 3 at MCRD Parris Island, which was chosen by the Navy and U.S. EPA in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The South Carolina Department of Health and Environmental Control (SCDHEC) concurs with the Selected Remedy. The final remedy for Site 3 adopts, with some limited modifications, certain remedial actions completed in 2001 to address contaminated soils and sediments at this former landfill site. The remedial actions were undertaken pursuant to a September 2000 Interim Record of Decision (IROD) for Site 3 (see Figure 1-1). The Final Remedy also adopts modifications to Land Use Controls (LUCs), adds an additional remedy component to address site soil cover maintenance, and other new components acknowledging that no remedial actions are needed with respect to certain lesser contaminated site sediments and adjacent surface waters.

FIGURE 1-1. SITE 3 LOCATION MAP

1.3 ASSESSMENT OF SITE

The response action selected in this ROD is necessary to protect the public health and welfare or the environment from actual or threatened releases of hazardous substances into the environment. Concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, arsenic, lead, mercury, and zinc in soil pose unacceptable risks to ecological receptors. Concentrations of dioxin-like polychlorinated biphenyls (PCBs), 4,4'-DDE, and mercury pose unacceptable risks to fishermen from fish consumption. A CERCLA action is required because of unacceptable risks to ecological receptors exposed to soil and to adult subsistence fishermen, child subsistence fishermen, child recreational fisherman, and U.S. EPA Region 4 default adult recreational fishermen.

1.4 DESCRIPTION OF SELECTED REMEDY

Pursuant to the aforementioned September 2000 IROD, interim remedial actions were undertaken for site surface soils and four areas of more highly contaminated site sediments. Those completed actions, which are now adopted as part of the final selected site remedy, one modification thereto, and certain additional components, as summarized below, comprise the final selected remedy for Site 3:

- Installation of slope stabilization and erosion controls along the sides of the full length of the causeway (Adopted/Completed).
- A soil cover over the sides and top of portions of the causeway (Adopted/Completed).
- A soil cover over the top of the four areas of sediment in the 3rd Battalion Pond (Adopted/Completed).
- Roadway construction/Sediment Testing (Adopted/Completed).
- Land use controls (LUCs) and periodic inspections.
    - Erection of Signs (providing notice of the use restrictions)
        - No unauthorized intrusive activities (e.g., drinking water well installation; unauthorized groundwater extraction; soil cover penetration, etc.)
        - No swimming or wading in 3rd Battalion Pond
        - Fishing restrictions (Modified)
    - Update Base Master Plan, GIS and EMS on LUC boundaries and land use restrictions (i.e., no residential use, etc.) (New)
    - Deed/lease restriction in the event of property transfer
    - Visual inspections to verify LUCs are effectively implemented.
- Long-Term Monitoring (Adopted with Modifications)
    - Inspect Cover Integrity (Modified)
    - Monitor Leachate from landfill with groundwater wells inside the unit boundary
- Maintenance of Soil Cover/Cap (New).
- No Action for Sediments (New).
- No Action for Surface Water (New).

The Selected Remedy eliminates potential unacceptable ecological and human exposure to contamination by limiting exposure to contaminated surface soil, sediment, and fish consumption. Contaminated soil and areas with more highly contaminated sediment have been covered with soil, fabric, and rip-rap (per the IROD), and LUCs will be implemented to ensure integrity of the landfill cover system, including soil, geotexitle, rip-rap, culverts, and other remedy components such as monitoring wells, etc.; prevent unacceptable uses of the site (residential, commercial, recreational, etc.) and unauthorized intrusive activities; and prohibit recreational activities (swimming, wading, or fishing) in the 3rd Battalion Pond, unless these recreational activities can be conducted while still ensuring that fish consumption does not occur. The remediation of Site 3 will not adversely impact the current and reasonably anticipated future land use of the site as a causeway, for vehicle and pedestrian traffic, connecting Horse Island with Parris Island. The Selected Remedy is expected to achieve substantial long-term risk

reduction and allow the property to be used for the reasonably anticipated future land use, which is non-residential. This ROD documents the final remedial action for Site 3 and does not include or affect any other sites at the facility. Implementation of this remedy will allow industrial/commercial reuse of the site, which is consistent with the overall cleanup strategy for MCRD Parris Island of restoring sites to support base operations.

1.5 STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. The Selected Remedy does not satisfy the statutory preference for remedies that use treatment as a principal element to reduce the toxicity, mobility, or volume of hazardous substances, pollutants, and contaminants. The type and location of contamination at Site 3 (polycyclic aromatic hydrocarbons [PAHs], arsenic, lead, mercury, and zinc in soil under the causeway and dioxin-like PCBs, 4,4'-DDE, and mercury in fish tissue) and the relatively low concentrations make treatment impracticable. EPA generally prefers to use the presumptive remedy of containment rather than treatment to address contamination such as that at Site 3, which poses a relatively low, long-term threat to human health and the environment.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted in accordance with CERCLA Section 121 (c) within 5 years of initiation of the remedial action and every 5 years thereafter, as needed to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 ROD DATA CERTIFICATION CHECKLIST

The locations in Section 2.0, Decision Summary, of the information required to be included in the ROD are summarized in Table 1-1. Additional information can be found in the Administrative Record file for MCRD Parris Island located in the information repository at the Beaufort County Public Library Headquarters (311 Scott Street, Beaufort, SC 29902).

TABLE 1-1. ROD DATA CERTIFICATION CHECKLIST

DATA	LOCATION IN ROD
Chemicals of concern (COCs) and their respective concentrations	Sections 2.5 and 2.7
Baseline risk represented by the COCs	Section 2.7
Cleanup levels established for COCs and the basis for these levels	Section 2.7 and 2.8
How source materials constituting principal threats are addressed	Section 2.11
Current and reasonably anticipated future land use assumptions used in the risk assessment	Section 2.6
Potential land and groundwater uses that will be available at the site as a result of the Selected Remedy	Section 2.12.3
Estimated capital, operating and maintenance (O&M), and total net present worth (NPW) costs; discount rate; and number of years over which the remedy costs are projected	Appendix B
Key factors that led to the selection of the remedy	Section 2.12.1

1.7 AUTHORIZING SIGNATURES

19 AUGUST 2011

L.E. REYNOLDS
Brigadier General, USMC
Commanding General
Marine Corps Recruit Depot, Parris Island, SC

Date

9/19/11

for Franklin E. Hill, Director
Superfund Division
EPA Region 4

Date

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

MCRD Parris Island, EPA ID number SC6170022762, is located along the southern coast of South Carolina, approximately 1 mile south of the Town of Port Royal and 3 miles south of the City of Beaufort, and occupies an area of approximately 8,047 acres. MCRD Parris Island is the reception and recruit training facility for the U.S. Marine Corps for enlisted men for states east of the Mississippi River and for enlisted women nationwide.

Site 3 is a former landfill located in the northwestern portion of MCRD Parris Island that now serves as a causeway connecting Horse Island to Parris Island (see Figure 2-1). From the 1960s until 1972, the causeway was gradually constructed across a tidal marsh using layers of solid waste, fill dirt, and other debris. During this time period Site 3 functioned as the major disposal area for all solid wastes discarded from dumpsters located throughout MCRD. Site 3 consists of the original landfill, the causeway constructed over the landfill, and sediments within 200 feet of the northeastern side of the causeway (within the 3rd Battalion Pond). Sediments within 200 feet of the northeastern side of the causeway are included in the site boundary to account for any waste material that could have eroded from the causeway into nearby sediments. At two locations along the causeway, three concrete pipes are buried beneath the causeway to allow tidal movement between the surface water bodies separated by the causeway.

MCRD Parris Island is an active facility, and environmental investigations and remediation at the base are funded under the Environmental Restoration, Navy (ER,N) program. The Navy is the lead agency for CERCLA activities at the facility, and EPA and SCDHEC are support agencies. Representatives of the National Oceanic and Atmosphere Administration, South Carolina Department of Natural Resources, and U.S. Fish and Wildlife Services also serve as natural resource trustees for MCRD Parris Island.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Site 3 functioned as the major disposal area for trash and other materials discarded in dumpsters around MCRD Parris Island during most of the period between 1960 and 1972. The discarded material is the suspected source of contamination at Site 3. Table 2-1 provides brief summaries of previous investigations at Site 3; additional information about terms in **blue text** is provided in the Administrative Record Reference Table included at the end of this ROD. Results of these investigations indicated elevated concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, arsenic, lead, mercury, and zinc in soil; anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, phenanthrene, pyrene, Aroclor-1254, 4,4'-DDD, 4,4'-DDE, 4,4'DDT, alpha-chlordane, and gamma-chlordane in sediment; and elevated concentrations of dioxin-like PCBs, 4,4'-DDE, and mercury in fish tissue.

TABLE 2-1. PREVIOUS INVESTIGATIONS AND SITE DOCUMENTATION

INVESTIGATION	DATE	ACTIVITIES
Initial Assessment Study (IAS)	1986	Conducted to identify potentially contaminated sites at MCRD Parris Island and identified Site 3 as a site requiring further investigation to assess potential long-term impacts to human health and the environment. Recommended verification sampling for Site 3.
Verification Step (VS)	1988	Included collection of eight shallow soil/sediment samples and eight surface water samples along the edges of the landfill at the waters edge during low tide, with analysis for volatile organic compounds (VOCs), acid and base/neutral extractable organics, PCBs, pesticides, total metals (arsenic, barium, beryllium, cadmium, chromium, selenium, and silver), and Extraction Procedure toxicity metals (arsenic, cadmium, chromium, lead, and mercury). Cadmium, lead, and mercury concentrations were elevated in some surface water and sediment samples. Based on VS results, additional sampling and analyses of food chain

TABLE 2-1. PREVIOUS INVESTIGATIONS AND SITE DOCUMENTATION

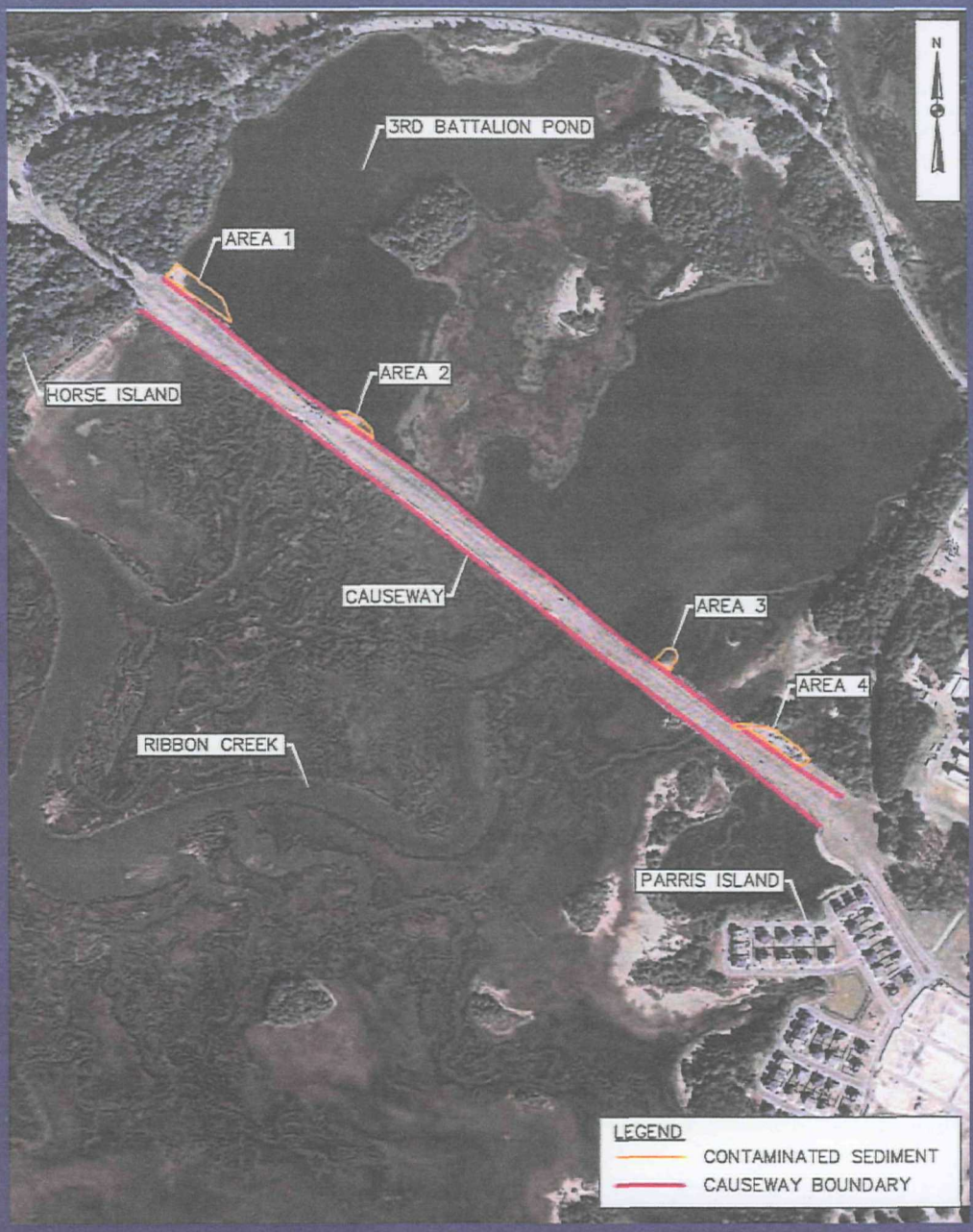
INVESTIGATION	DATE	ACTIVITIES
		models were recommended to address potential concerns regarding the consumption of shellfish and fish in the vicinity of Site 3.
Interim Resource Conservation and Recovery Act (RCRA) Facilities Assessment	1990	Indicated that there was documented disposal of wastes containing hazardous constituents in an unlined unit in the immediate vicinity of surface waters and that a RCRA Facility Investigation (RFI) was necessary.
Extended Site Inspection	1993	Evaluated whether consumption of fish and shellfish caught in the vicinity of the Causeway Landfill posed a risk to human health. Fish and shellfish commonly harvested in the area were sampled and analyzed for mercury, PAHs, PCBs, and pesticides. Elevated levels of pesticides and PCBs in tissues from the 3rd Battalion Pond side of the causeway raised concerns over ecological issues. Mercury amalgam, identified as having been disposed of in the landfill, could have an ecological impact if detected in site media.
RCRA Facilities Investigation (RFI) /Remedial Investigation (RI)	1998-1999	Sixteen surface soil samples, five subsurface soil samples, 20 surface water samples, 21 sediment samples and four groundwater samples were collected in May/June 1998. The field investigation also included a tidal study and aquifer tests and the establishment of background concentrations. Twelve additional sediment samples were collected in August 1999 to better delineate contamination in previous sediment samples. The RFI identified surface soil and sediment as the primary media of concern based on elevated concentrations of PAHs, PCBs, pesticides, and metals.
Feasibility Study (FS)	2000	Based on the RFI/RI, a FS was prepared in 2000 to evaluate remedial action alternatives.
Interim Record Of Decision (IROD)	2000	The IROD, signed in September 2000, addressed the risk posed by the waste materials and the most significantly impacted sediment and consisted of the following actions (all actions now complete): • **Placement of a protective cover** over the top and both sides of the causeway to prevent humans and wildlife from contacting waste material. • **Stabilization of both of the causeway's banks** by regrading, adding rip-rap (rocks), and planting vegetation along the sides of the causeway. • **Construction of a paved road** along the top of the causeway (reducing infiltration of precipitation into waste material and reducing erosion of cover material). • **Covering the four areas of contaminated sediment** along the base of the causeway. • **Recharacterization of sediment** after implementation of IROD. • **Implementation of LUCs** including prohibition of unauthorized intrusive/construction activities, prohibition of swimming and wading, prohibition of residential development of the site and use of the site's groundwater as potable water, and prohibition of subsistence fishing. • **Long-term monitoring** of groundwater (annual groundwater sampling and analysis for 5 years).
Sediment Recharacterization	2001	Per the IROD collection of 20 sediment samples (15 on the 3rd Battalion Pond side of the causeway and five samples on the marsh side of the causeway) in depositional areas just beyond the edge of the newly installed rip-rap and cover fabric. The samples were analyzed for chemicals based on the recommendations of the RFI Report for each area. One of the sediment samples within 3rd Battalion Pond Side Area 4 contained 4,4'-DDD at an elevated (above background/typical facility) concentration.
Sediment Sampling	2003	During the November 2002 MCRD Parris Island Partnering Team meeting it was decided that EPA would collect additional sediment samples in the area of the 2001 sediment sample with the elevated 4,4'-DDD concentration to determine if it was an isolated detection. Three sediment sample were collected and analyzed for 4,4'-DDD, 4,4'DDE, 4,4'-DDT, arsenic, lead,

TABLE 2-1. PREVIOUS INVESTIGATIONS AND SITE DOCUMENTATION

INVESTIGATION	DATE	ACTIVITIES
		mercury, and total organic carbon. Results indicated that the 2001 elevated 4,4'-DDD concentration appeared to be an isolated occurrence.
Fish Tissue Sampling	2009	Based on the results of an interview with a site-specific civilian fisher person, who can be classified as a highly exposed individual, and on regulatory agency comments received on the draft Post-Interim Construction Risk Assessment, fish samples were collected from four areas within the 3rd Battalion Pond and from a reference area. Human health risks were evaluated for the military recreational fisherman, civilian recreational fisherman, civilian subsistence fisherman, and standard EPA Region 4 default fisherman, all of which included child and adult receptors.
Post-Interim Remedy Construction Risk Assessment	2010	Recharacterization of sediment at Site 3 was a provision of the IROD and the uncertainty about the representativeness of sediment uptake models required the risk assessment to include both sediment and fish tissue data collected after implementation of the interim response action. Sediment samples collected in 2001 and 2003 and fish tissue samples collected in 2009 were used to evaluate post-construction risks to human health and the environment. Based on data from the 2009 fish tissue sampling, the human health risks from fish consumption indicate potential unacceptable risks for the adult and child subsistence fishers; child recreational fisherman (military and civilian); and the EPA Region 4 default fisher. Based on data from the 2001 and 2003 sediment sampling, negligible site-related risks to benthic invertebrates exist.

There have been no cited violations under federal or state environmental law or any past or pending enforcement actions pertaining to remedial actions at Site 3.

FIGURE 2-1. SITE LOCATION



2.3 COMMUNITY PARTICIPATION

The Navy performs public participation activities in accordance with CERCLA, RCRA and, to the extent practicable, the NCP throughout the site cleanup process at MCRD Parris Island. The RFI/RI Report and FS Report for Site 3 have been available to the public since 2000. The Technical Memorandum Post-Interim Construction Risk Assessment has been available to the public since September 2010. The Proposed Plan became available to the public on February 25, 2011. They can be found in the Administrative Record file, which is part of the Information Repository maintained at the Beaufort County Public Library Headquarters at 311 Scott Street, Beaufort, South Carolina.

In accordance with Sections 113 and 117 of CERCLA, the Navy provided a public comment period from February 25 to April 25, 2011, for the proposed remedial action described in the Proposed Plan for Site 3. A public meeting to present the Proposed Plan to a broader community audience was held March 15, 2011, at MCRD Parris Island. At this meeting, representatives of the Navy, Marine Corps, EPA, and SCDHEC answered questions about the site and the remedial alternatives. The Navy's responses to the comments received during this period are included in the Responsiveness Summary of this ROD. Public notice of the meeting and availability of documents was published in the Beaufort Gazette on February 25, 26, and 27, 2011.

2.4 SCOPE AND ROLE OF OPERABLE UNIT

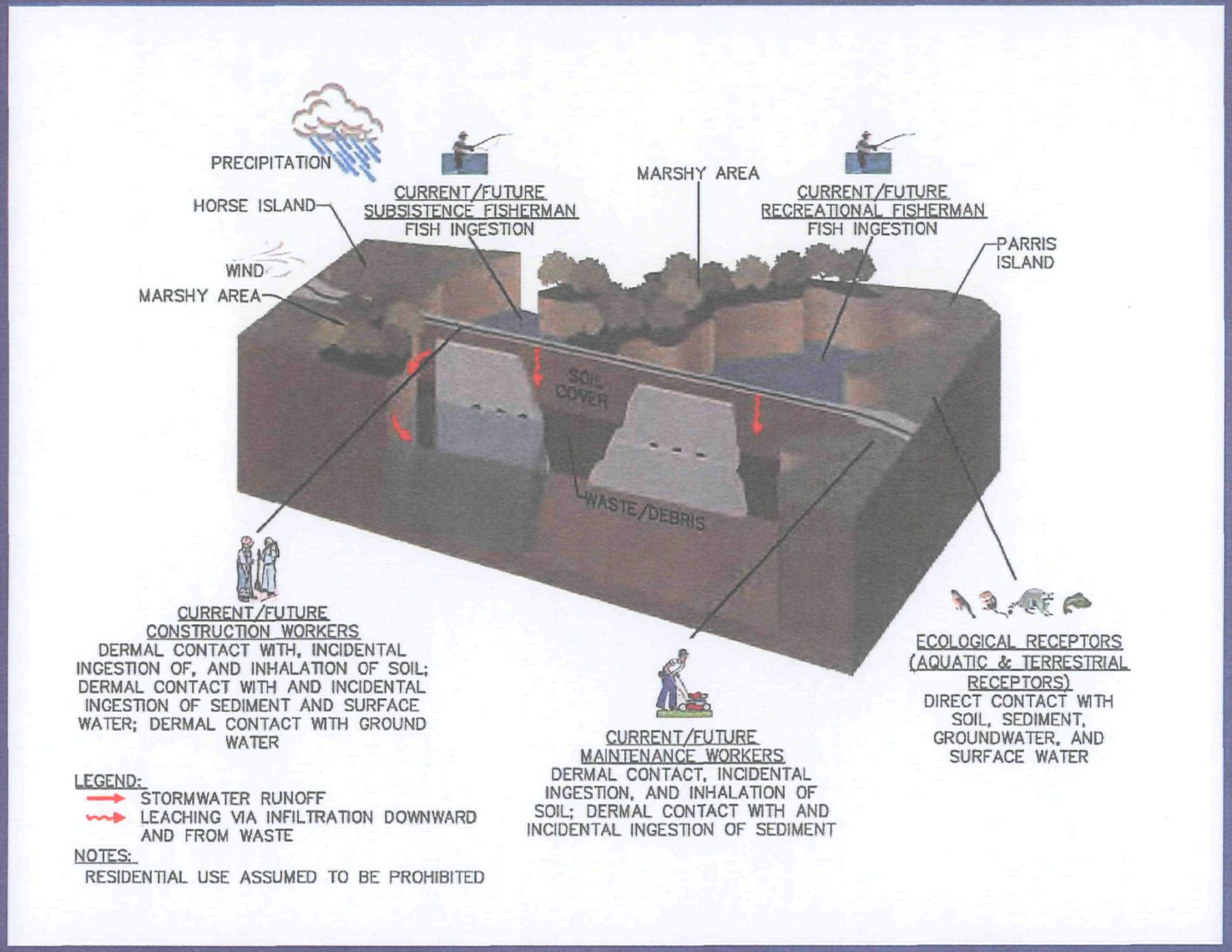
Site 3 is part of a comprehensive environmental investigation and cleanup program currently being performed at MCRD Parris Island under CERCLA authority pursuant to the Federal Facility Agreement (FFA) dated March 31, 2006. Installation Restoration (IR) Program cleanup activities are being performed under CERCLA, except at those sites subject to the Underground Storage Tank (UST) Program and Munitions Response Programs (MRP). Fifty-five IR sites have been identified at MCRD Parris Island. Preliminary Assessments are needed for Sites 8, 39, 46, 47, 48, 49, and 52. Site Investigations (SIs) are being conducted for Sites 4, 13, and 35. RIs and FS are currently underway for Sites 5, 7, 9, 14, 16, 27, 45, and 55. No Further Action RODs were signed for Sites 2 and 15 in September 2006. The remaining IR sites are accounted for in the FFA. The Site Management Plan (SMP) for MCRD Parris Island further details the schedule for CERCLA activities and is updated annually.

Investigations at Site 3 indicated the presence of soil and sediment contamination from past operating practices that posed unacceptable risk to current and future ecological receptors and current and future human receptors and the presence of fish tissue contamination that poses potential unacceptable risks to current and potential future human receptors (via fish consumption). Previous actions taken in response to the contamination at Site 3 are summarized in Table 2-1. In September 2000 an IROD was issued that documented the decision to undertake the proposed interim remedial actions for surface soil and four areas of more highly contaminated sediments. The remedy documented in this ROD will achieve the Remedial Action Objectives (RAOs) for Site 3, as listed in Section 2.8. Implementation of this remedy will allow non-residential reuse of the site, which is consistent with current and reasonably anticipated future use and the overall cleanup strategy for MCRD Parris Island of restoring sites to support base operations.

2.5 SITE CHARACTERISTICS

Figure 2-2 presents the Site 3 conceptual site model (CSM), which identifies contaminant sources, contaminant release mechanisms, transport routes, and receptors under current and future land use scenarios. The source of contamination at Site 3 is the buried waste under the causeway. Contaminants may be released from the causeway by mechanisms such as storm water runoff and subsequent erosion of surface soil, leaching of COCs from soil and waste via infiltrating water and subsequent migration to the water table, or wind erosion of surface soil. Human health and ecological receptors are discussed in Sections 2.7.1 and 2.7.2, respectively.

FIGURE 2-2. CONCEPTUAL SITE MODEL



2.5.1 Physical Characteristics

Site 3 consists of the original landfill, the causeway constructed over the landfill, and sediment within 200 feet of the northeastern side of the causeway. The causeway currently separates the 3rd Battalion Pond from a marshy area to the southwest. The waste in the causeway has been covered with at least two feet of compacted soil. The four sediment areas on the 3rd Battalion side of the causeway have been covered with at least one foot of soil, fabric, and rip-rap. The causeway is now an asphalt two-lane road with an adjacent bike/jogging trail. The soil cover, asphalt road, and sediment cover were added as part of the Interim Remedial Action (IRA) in accordance with the IROD.

Surface soil collected from the causeway landfill consisted of fine to medium sands with varying silt content. Rip-rap consisting of concrete fragments was observed along the banks of the causeway. Sediment samples collected from the marsh and 3rd Battalion Pond consisted of silts and clay, with varying sand content.

Generally, the shallow subsurface geology of the study area consists of fill material and a heterogeneous mixture of tidal and storm-deposited clay and sand. In the center of the causeway, fill material was encountered to depths of at least 10.5 to 18 feet below ground surface (bgs). The fill soils consisted of sand with varying amounts of silt. The observed refuse within the soil boring samples consisted of large amounts of wood fragments along with metal fragments (cans), paper, plastics, and fragments of concrete and brick. The boundary between fill and natural materials is fairly distinct. Beneath the fill, overburden materials consist of tidal sands with varying silt content to a depth of 28 feet bgs. From 28 feet bgs to the termination of borings at 40 feet bgs, clay was encountered. If continuous throughout the site, the underlying clay is thick enough to act as a confining unit to the overlying sands of the upper surficial aquifer. The upper surficial aquifer across Site 3 is approximately 18 to 20 feet thick, based on the depth of the clay unit encountered.

2.5.2 Nature and Extent and Fate and Transport of Contamination

As stated above, it is suspected that wastes disposed of in the causeway are the likely source of soil and fish tissue contamination. A summary of soil sample results, based on RI data, and fish tissue results, from the 2009 sampling, is presented in Table 2-2. The contaminants in this table were addressed through the interim action.

Detected concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene exceeded the remediation goals established in the IROD in one soil sample at the southern end of the site, as shown on Figure 2-3. Concentrations of all PAH COCs exceeded their respective remediation goals at this one location. Concentrations of the metal COCs exceeded their respective remediation goals in four samples, as depicted on Figure 2-3.

Total dioxin-like PCBs, 4,4'-DDE, and mercury were detected in concentrations exceeding subsistence fishermen screening levels in fish tissue collected from 3rd Battalion Pond. Concentrations of total dioxin-like PCBs exceeded the subsistence fishermen screening level in all 18 fish tissue samples, and concentrations of 4,4'-DDE exceeded the subsistence fishermen screening level in 17 fish tissue samples. Concentrations of mercury exceeded the subsistence fishermen screening level in nine fish tissue samples, and detection limits for the non-detected samples exceeded the subsistence fisherman screening level.

PCBs and PAHs are non-polar hydrocarbons that have a strong affinity for sediment and suspended solid particles. PAHs are somewhat more susceptible to biodegradation, but both PCBs and PAHs are considered persistent in the environment. PCBs and PAHs are only slightly volatile and have very low aqueous solubilities. Similar to PCBs and PAHs metals are highly persistent in the environment. Metals adsorb to soil and remain bound to particulate matter. Because of this, metals tend to migrate from source areas via bulk movement processes (e.g., transport by wind erosion or with suspended

particulates in water). If leaching from soil to groundwater occurs, it usually results in transportation of metals over relatively short distances.

Sediment samples collected before the remedial actions were found to contain several PAHs, pesticides, lead, arsenic, aluminum, copper, iron, mercury, and zinc at concentrations greater than background sediment concentrations and in exceedance of the residential human health risk based concentrations or ecological screening values. Analysis of sediment concentrations after the remedial activities showed that concentrations decreased and no unacceptable human health risks or ecological risks remained in sediment.

Surface water samples collected before the remedial actions were found to contain acetone, semivolatiles, and inorganics. Human health and ecological risk assessments found that risks were negligible.

TABLE 2-2. SUMMARY OF RESULTS FOR COCS

COC	FREQUENCY OF DETECTION	RANGE OF DETECTIONS
Soil (1998-1999 RFI/RI)		
PAHs (µg/kg)		
Benzo(a)anthracene	10/16	3-3,000
Benzo(a)pyrene	10/16	4.1-4,000
Benzo(b)fluoranthene	15/16	2.2-3,400
Benzo(g,h,i)perylene	5/16	9.3-2,500
Benzo(k)fluoranthene	11/16	1.7-1,300
Chrysene	13/16	3.6-2,900
Indeno(1,2,3-cd)pyrene	10/16	2.6-2,600
Metals (mg/kg)		
Arsenic	16/16	0.44-11.8
Lead	16/16	5.5-264
Mercury	6/16	0.0375-0.43
Zinc	16/16	5.7-205
Fish Tissue (2009 Sampling)		
PCBs (ng/kg)		
Dioxin-like PCBs	18/18	180-7,807
Pesticides (µg/kg)		
4,4'-DDE	18/18	1.5-71
Metals (mg/kg)		
Mercury	7/18	0.0155-0.564

FIGURE 2-3. SOIL SAMPLE LOCATIONS AND RESULTS

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

MCRD Parris Island is located along the southern coast of South Carolina, approximately 1 mile south of the Town of Port Royal and 3 miles south of the City of Beaufort within Beaufort County. MCRD Parris Island covers approximately 8,047 acres that consist of dry land, salt marshes, saltwater creeks, and ponds. MCRD Parris Island is the reception and recruit training facility for the Marine Corps for enlisted men from states east of the Mississippi River and for enlisted women nationwide.

Site 3 is a former landfill that now serves as a causeway connecting Horse Island and Parris Island, in the northern section of MCRD Parris Island. Site 3 also includes the 3rd Battalion pond (a surface water resource) that has historically been used for limited recreational activities (i.e., fishing, canoeing). MCRD plans to use the site only as a traffic route, its current use, as documented in the MCRD Parris Island Master Plan. The area has been used as such since 1972. Similarly, site groundwater is not currently used as a potable water supply nor is it expected to be used as such in the future. There are no off-site residents located downgradient in the immediate vicinity of the site that might use groundwater as a potable water supply. The surface water of Site 3 is also not currently used as a potable water supply.

2.7 SUMMARY OF SITE RISKS

The baseline risk assessment estimates what risks the site poses if no action was taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. Risk characterization was originally conducted as part of the RFI in 1999, and a Post-Interim Construction Risk Assessment was completed in 2010 after implementation of the IRA.

2.7.1 Summary of Human Health Risk

A quantitative Human Health Risk Assessment (HHRA) was conducted as part of the RFI in 1999 using chemical concentrations detected in soil, sediment, groundwater, and surface water samples. A second quantitative HHRA completed in 2010 evaluated chemical concentrations in fish tissue. Key steps in the risk assessment process included identification of Chemicals of Potential Concern (COPCs), exposure assessment, toxicity assessment, and risk characterization. Appendix C.1 presents the supporting HHRA information for the 1999 RFI HHRA, and Appendix C.2 presents the supporting information for the 2010 Post-Interim Construction HHRA.

Identification of COPCs

Tables 3.1 through 3.4 from the 1999 RFI (included in Appendix C.1) and Table 3.1 from the 2010 Technical Memorandum (included in Appendix C.2) present exposure point concentrations (EPCs) for the COPCs identified at Site 3 for each medium. EPCs are the concentrations used in the risk assessment to estimate exposure and risk from each COPC. For each COPC, information in the tables includes the arithmetic mean, maximum detected concentration, 95-percent upper confidence limit (UCL) on the mean, EPC, and how the EPC was derived. Maximum detected concentrations or 95-percent UCLs on the mean were used as the EPCs for Site 3 COPCs. The specific method used to calculate the 95-percent UCL is presented on tables in Appendix C.

Exposure Assessment

During the exposure assessment, current and potential future exposure pathways through which humans might come into contact with the COPCs identified in the previous step were evaluated. The results of the exposure assessment for Site 3 were used to refine the CSM (Figure 2-2), which identifies potential contaminant sources, contaminant release mechanisms, transport routes, and receptors under current and future land use scenarios. Soil, sediment, groundwater and surface water were identified as the media of concern. Potential exposure routes for soil include incidental ingestion (swallowing small amounts of soil), dermal contact (skin exposure), and inhalation. Potential exposure routes for groundwater include dermal contact. Potential exposure routes for sediment and surface water include incidental ingestion, dermal contact, and consumption of fish tissue. The 1999 HHRA considered receptor exposure under non-residential land use (construction workers, maintenance workers, and

recreational users), and the 2010 HHRA considered receptor exposure for recreational users (fisherman). Due to current and reasonably anticipated future use of Site 3, it was assumed that residential use would be prohibited. Current and hypothetical future exposure pathways at Site 3 are summarized in Table 2-3.

TABLE 2-3. RECEPTORS AND EXPOSURE ROUTES EVALUATED IN HHRAS

RECEPTOR	EXPOSURE ROUTE
1999 RFI/RI	
Construction Workers (current and future land use)	Soil – dermal contact, incidental ingestion, and inhalation Sediment – dermal contact and incidental ingestion Groundwater – dermal contact Surface water – dermal contact and incidental ingestion
Maintenance Workers (current and future land use)	Soil – dermal contact, incidental ingestion, and inhalation Sediment – dermal contact and incidental ingestion
Recreational Users (fishermen) (child and adult) (current and future land use)	Sediment and surface water – ingestion of fish tissue (calculated and fish tissue samples)
2010 Post-Interim Construction Risk Assessment	
Recreational Fisherman (child and adult) (current and future land use)	Sediment and surface water – ingestion of fish (fish tissue)
Subsistence Fisherman (child and adult) (current and future land use)	Sediment and surface water – ingestion of fish (fish tissue)
EPA Default Fisherman (current and future land use)	Sediment and surface water – ingestion of fish (fish tissue)

Toxicity Assessment

Toxicity assessment involves identifying the types of adverse health effects caused by exposure to site COPCs and determining the relationship between the magnitude of exposure and the severity of adverse effects (i.e., dose-response relationship) for each COPC. Based on the quantitative dose-response relationships determined, toxicity values for both cancer (cancer slope factor [CSF]) and non-cancer (reference dose [RfD]) effects were derived and used to estimate the potential for adverse effects.

Table 5.1 in Appendix C.1 and Table 5.1 in Appendix C.2 provide non-carcinogenic hazard information relevant to Site 3 COPCs for oral and dermal routes of exposure for the HHRAs in 1999 and 2010, respectively. Chronic toxicity data available for oral exposure to these COPCs have been used to develop oral RfDs ranging from 1×10^{-9} to 1 mg/kg-day. A RfD represents a level to which an individual may be exposed that is not expected to cause any deleterious effect. The dermal RfDs are also presented in these tables and range from ($1x10^{-9}$ to 0.1 mg/kg-day). An adjustment factor is sometimes applied to extrapolate dermal values from oral values, dependent on how well the chemical is absorbed via the oral route. The adjustment factors and the adjusted dermal slope factors are presented in Table 5.1 in Appendix C.1 and Table 5.1 in Appendix C.2.

Table 6.1 in Appendix C.1 and C.2 (from the 1999 RFI/RI and 2010 HHRA, respectively) provide carcinogenic risk information relevant to the Site 3 COPCs for oral and dermal exposure for each risk assessment. At this time, CSFs are not available for the dermal route of exposure; therefore, dermal slope factors were extrapolated from oral values. The adjustment factors and the adjusted dermal slope factors are presented in Table 6.1 in Appendix C.1 and Table 6.1 in Appendix C.2.

Risk Characterization

During the risk characterization, the outputs of the exposure and toxicity assessments are combined to characterize the baseline risk (non-cancer hazards and cancer risks) at the site if no action was taken to address the contamination. Potential non-cancer hazards and cancer risks were calculated.

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., a lifetime) to a RfD derived for a similar exposure period. The ratio of exposure to toxicity is called a hazard quotient (HQ). A HQ less than 1 indicates that a receptor's dose of a single contaminant is less than the RfD and that toxic non-carcinogenic effects from that chemical are unlikely. The hazard index (HI) is generated by adding the HQs for all chemicals that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may be reasonably exposed. A HI less than 1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. A HI greater than 1 indicates that site-related exposures may present a risk to human health. The HQ is calculated as follows:

$$\text{Non-cancer HQ} = \text{CDI} / \text{RfD}$$

where: CDI = chronic daily intake averaged over 70 years (in mg/kg-day)
RfD = reference dose

CDIs and RfDs are expressed in the same units and represent the same exposure period (i.e., chronic, sub-chronic, or acute).

Tables 9.1 through 9.4 in Appendix C.1 provide non-cancer HQs for each receptor and route of exposure and total HIs for all routes of exposure from the 1999 RFI/RI HHRA. The 1999 RFI/RI HHRA calculated risks for current and future construction workers, maintenance workers, and recreational fishermen. Risks for construction workers were evaluated based on exposure to soil, groundwater, sediment, and surface water. Total HIs for all applicable exposure routes range from 0.47 for current and future construction workers to 17.8 for adult recreational users.

Tables 9.1 through 9.6 in Appendix C.2 provide non-cancer HQs for sediment and surface water exposure by fish ingestion from the Post-Interim Construction HHRA. Total HIs range from 1 for adult military and civilian fisherman to 19 for child subsistence fishermen.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$\text{Risk} = \text{CDI} \times \text{SF}$$

where: risk = a unitless probability (e.g., 2×10^{-5}) of an individual developing cancer
CDI = chronic daily intake averaged over 70 years (in mg/kg-day)
SF = slope factor (in mg/kg-day^{-1})

These calculated risks are probabilities that are usually expressed in scientific notation (e.g., 1×10^{-6} which is one in one million). An excess incremental lifetime cancer risk (ILCR) of 1×10^{-6} under a reasonable maximum exposure (RME) scenario indicates that an individual experiencing the RME estimate has an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposures is between one in one million and one in ten thousand (1×10^{-6} and 1×10^{-4}).

Tables 9.1 through 9.4 in Appendix C.1 provide cancer risk estimates for surface soil, sediment, groundwater, and surface water for the significant receptors and routes of exposure developed by taking into account various conservative assumptions about the frequency and duration of exposure for each receptor and also about the toxicity of the COPCs. Main contributors (risk greater than 1×10^{-5}) to cancer risks from surface water and sediment through fish ingestion include carcinogenic PAHs, PCBs, and arsenic. Total risk estimates for all applicable exposure routes range from 1.7×10^{-5} for current and future

construction workers to 1.8 x 10^{-3} for recreational fisherman exposed to surface water and sediment by fish ingestion (calculated fish tissue concentrations). These risk levels indicate that if no cleanup action was taken, the increased probabilities of developing cancer as a result of site-related exposure would range from approximately two in 100,000 to two in 1,000.

Tables 9.1 through 9.6 in Appendix C.2 provide cancer risk estimates for sediment and surface water exposure by fish ingestion for the Post-Interim Construction HHRA. Main contributors (risk greater than 1 x 10^{-5}) to cancer risks from sediment/surface water through fish ingestion include dioxin-like PCBs and 4,4'-DDE. Total risk estimates for exposure to surface water/sediment through fish ingestion range from 8 x 10^{-6} for the adult military recreational fishermen to 7 x 10^{-4} for the adult subsistence fishermen. These risk levels indicate that if no cleanup action was taken, the increased probabilities of developing cancer as a result of site-related exposure would range from approximately eight in 1,000,000 to seven in 10,000.

The 1999 RFI/RI HHRA calculated risks for current and future construction workers, maintenance workers, and recreational fishermen. Risks for construction workers were evaluated based on exposure to soil, groundwater, sediment, and surface water. The HI for construction workers was 0.47 and the ILCR was 1 x 10^{-5}, indicating that adverse non-carcinogenic and carcinogenic risks are not anticipated for construction workers. Risks for maintenance workers were evaluated based on exposure to soil and sediment. The HI for maintenance workers was 0.064 and the ILCR was 6 x 10^{-6}, indicating that adverse non-carcinogenic and carcinogenic risks are not anticipated for maintenance workers. Risks for adult recreational users were evaluated based on exposure to surface water and sediment ingestion through fish consumption. Two fisherman scenarios were evaluated for exposure to fish concentrations (EPA Region 4 default fisherman and site-specific fisherman). Risks for both fishermen were evaluated using measured fish tissue concentrations, and fish tissue concentrations calculated based on maximum sediment and surface water concentrations and average sediment and surface water concentrations. HIs for fish consumption for the default fisherman and the site-specific fisherman based on fish tissue samples were 2.4 and 0.83 and ILCRs were 5 x 10^{-5} and 3 x 10^{-6}. Based on fish tissue samples, adverse non-carcinogenic risks are anticipated for the EPA Region 4 default fisherman. HIs for fish consumption for the default fisherman and site-specific fisherman based on maximum sediment and surface soil concentrations were 19 and 6.1 and ILCRs were 2 x 10^{-3} and 1 x 10^{-4}. Carcinogenic and non-carcinogenic risks are anticipated for the EPA Region 4 default fisherman and site-specific fisherman, based on calculated fish tissue concentrations using maximum sediment and surface water concentrations. HIs for fish consumption for the default fisherman and site-specific fisherman, based on average sediment and surface water concentrations were, 2.2 and 1.4 and ILCRs were 2 x 10^{-4} and 1 x 10^{-5}. Non-carcinogenic risks are anticipated for the EPA Region 4 site-specific fisherman and carcinogenic risks are anticipated for the EPA Region 4 default fisherman when based on calculated fish tissue concentrations using average sediment and surface water concentrations.

The 2010 post-interim remedy construction HHRA evaluated potential exposures to recreational users through fish ingestion because the direct contact exposures to sediment were within the EPA acceptable risk range in the RFI/RI HHRA. Sediment concentrations in post-IRA samples are not significantly different than in pre-interim remedial action samples. As a result of concerns expressed by EPA and SCDHEC with the methods used to establish potential concentrations of COPCs in fish tissue using sediment data, fish tissue samples were collected.

Concentrations of COPCs in fish tissue were used to evaluate risks to military recreational fishermen, civilian recreational fishermen, civilian subsistence fishermen, and standard EPA Region 4 default fishermen. The HIs for adult recreational military and civilian fishermen were equal to the target HI of 1.0, and HIs for child recreational fisherman, child subsistence fishermen, adult subsistence fishermen, and EPA default recreational fisherman were greater than 1. The ILCR for child recreational fishermen, child subsistence fishermen, adult recreational military fisherman, adult recreational civilian fishermen, and the EPA default fishermen exceeded 1 x 10^{-6} but were less than 1 x 10^{-4}. The ILCR for adult subsistence fishermen was 7 x 10^{-4}, which exceeds the upper bound of the EPA acceptable risk range.

No major sources of uncertainty, other than those typically associated with risk assessment estimates, were identified for the 1999 Site 3 HHRA. Major sources of uncertainty associated with the Post-Interim

Construction HHRA include mobility of fish in and out of the 3rd Battalion Pond, quantity and type of fish consumed from the 3rd Battalion Pond, national presence of mercury in fish, and PCB evaluation (fish tissue samples were not analyzed for non dioxin-like PCBs). Details about the uncertainties associated with the Post-Interim Construction HHRA can be found in the Technical Memorandum for the Post-Interim Construction Risk Assessment (Tetra Tech, July 2010).

Based on the results of the HHRAs, risks were identified that require a response action, including unacceptable cancer risks for adult recreational fishermen and adult subsistence fishermen, and non-cancer risks for child recreational fishermen, child subsistence fishermen, adult subsistence fishermen, and default adult recreational fishermen.

2.7.2 Summary of Ecological Risk

Screening-level ecological risk assessments (ERAs) were completed at Site 3 for the 1999 RFI/RI and as part of post-interim construction evaluation in accordance with Steps 1 through 3 of the Navy's ERA process. Step 1 of the process consists of problem formulation and ecological effects evaluation, and Step 2 includes exposure assessment and calculation of risk based on conservative exposure assumptions. Step 3a involves refinement of the list of previously identified COPCs and recalculation of risks based on more realistic exposure assumptions.

As part of the 1999 RFI/RI ERA, potential ecological risks were evaluated for aquatic, semi-aquatic, and terrestrial receptors. Exposure pathways for aquatic and semi-aquatic organisms include direct contact with surface water and sediment, incidental ingestion of surface water and sediments, consumption of contaminated food items, and groundwater that discharges to surface water in the marsh. Terrestrial animals could be exposed to soil and surface water contaminants through ingestion of contaminated food items and incidental ingestion of soil and surface water. Terrestrial vegetation can be exposed to contaminants by direct contact or root translocation.

Representative receptors evaluated during the 1999 RFI/RI included benthic invertebrate communities, forage fish represented by the mummichog, upper trophic level fish represented by the red drum, piscivorous birds represented by the great blue heron and bald eagle, omnivorous birds represented by the American robin, carnivorous birds represented by the red-tailed hawk, omnivorous mammals represented by the raccoon, herbivorous mammals represented by the cotton mouse, insectiviorous mammals represented by the short-tailed shrew, and terrestrial and aquatic vegetation.

Site 3 soil, sediment, groundwater, and surface water data from the 1999 RFI/RI were first compared to EPA Region 4 ecological screening criteria to generate an initial list of COPCs. A chemical was selected as an ecological COPC if its maximum site concentration exceeded the minimum screening criteria.

COPCs for soil included three VOCs, 4-methylphenol, bis(2-ethylhexyl)phthalate, carbazole, dibenzofuran, 13 PAHs, 4,4'-DDE, 4,4'-DDT, alpha-chlordane, Aroclor-1254, Aroclor-1260, gamma-chlordane, and seven metals. Screening indices for the soil COPCs (calculated by dividing maximum site concentrations by screening values) ranged from 1.2 to 216 and give a sense of the relative magnitude of exceedances. Screening indices greater than 1.0 indicate potential risk.

COPCs for sediment included 2-butanone, acetone, carbon disulfide, chloroform, carbazole, dibenzofuran, 10 PAHs, 4-4'-DDD, 4,4'-DDE, 4-4'-DDT, alpha-chlordane, Aroclor-1254, Aroclor-1260, gamma-chlordane, and 15 metals. Screening indices for these sediment COPCs ranged from 1 to 237.

COPCs for groundwater included carbon disulfide, chlorobenzene, total xylenes, 2-methylnaphthalene, 4-methyphenol, bis(2-ethylhexyl) phthalate, and three metals. Only chlorobenzene had a screening index of 1.2; the remaining COPCs did not have screening criteria and did not have screening indices.

COPCs for surface water included acetone, bis(2-ethylhexyl) phthalate, nine PAHs, and 16 metals. Screening indices for surface water COPCs ranged from 1.2 to 52.4.

Fish tissue sample analytical results were compared to protective tissue guidelines. Mercury was the only chemical detected at concentrations greater than protective tissue guidelines.

Further evaluation in the 1999 RFI/RI included Step 2, a conservative screening process for estimating exposure and calculating risks through food-chain modeling. Food-chain models were evaluated for terrestrial and aquatic receptors. Terrestrial receptors were represented by the shrew, mouse, robin, and hawk, and aquatic receptors were represented by the raccoon, heron, mummichog, red drum, and bald eagle. Exposure pathways were discussed previously. Food-chain models were constructed based on maximum and average concentrations of COPCs. All COPCs identified in soil, sediment, and surface water were used in the food-chain modeling. Groundwater data were not used in food-chain modeling because aquatic and semi-aquatic organisms are not directly exposed to groundwater. Potential groundwater discharge to aquatic environments is taken into account through the evaluation of sediment and surface water COPCs.

For Step 2, HQs were calculated as ratios of exposure levels to toxicity reference values (TRVs), which are estimates of the maximum levels of a chemical that an ecological receptor can safely ingest in its diet (no-observable-adverse-effects levels [NOAELs]) and which are derived from literature studies of the chronic effects of various chemicals on mammals and birds. For the surface soil terrestrial food-chain model, HQs were greater than 1.0 for seven metals, Aroclor-1254, and Aroclor-1260 using maximum concentrations, and the HQ for 4,4'-DDE slightly exceeded 1.0 for the robin using the mean concentration. The HQ for 4,4'-DDE exceeded 1.0 in the food-chain model based on the mean concentration but not based on the maximum concentration because 4,4'-DDE was only detected in one sample and the concentration in that sample was less than the mean concentration using one-half of the detection limit.

Based on the aquatic food-chain model using sediment and surface water data, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Aroclor 1254, and eleven metals had HQs greater than 1.0 using maximum concentrations; and 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and seven metals had HQs greater than 1.0 using mean concentrations. HQs for aquatic food-chain models using maximum filtered surface water results exceeded 1.0 for four metals, and HQs for aquatic food-chain models using mean filtered surface water results exceeded 1.0 for three metals.

In Step 3a, the Site 3 food-chain model was repeated using less conservative exposure assumptions and screening criteria, including lowest-observed-adverse-effects levels (LOAELs). The less conservative food-chain model reduced the list of chemicals for which NOAEL HQs exceeded 1.0 to : 4,4'-DDT, 4,4'-DDE, 4,4'-DDT, aluminum, arsenic, iron, lead, mercury, thallium, vanadium, and zinc.

As part of the post-interim remedy construction ERA, potential ecological risks from exposure to sediment were evaluated for benthic organisms, aquatic organisms, and upper trophic-level animals in the 3rd Battalion Pond and marsh. The sediment data were organized into five data sets representing the marsh south of the causeway and Areas 1, 2, 3, and 4 north of the causeway. Ecological risks were evaluated for each of the five separate data sets to address risks to benthic and aquatic organisms and were also evaluated site-wide to address birds and mammals.

Sediment concentrations were first compared to ecological screening values (ESVs) to generate an initial list of COPCs. Chemicals selected as COPCs in sediment in the marsh south of the causeway were 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, total DDT, alpha-chlordane, arsenic, copper, 14 individual PAHs, and total PAHs. Chemicals selected as COPCs in sediment in 3rd Battalion Pond Side Area 1 were arsenic, mercury, and benzo(b)fluoranthene. Chemicals selected as COPCs in sediment in 3rd Battalion Pond Side Area 2 were arsenic, copper, and lead. Chemicals selected as COPCs in sediment in 3rd Battalion Pond Side Area 3 were 4,4'-DDD, 4,4'-DDT, total DDT, and gamma-chlordane. Chemicals selected as COPCs in sediment in 3rd Battalion Pond Side Area 4 were 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, total DDT, alpha-chlordane, gamma-chlordane, lead, and mercury. Chemicals selected as COPCs for the entire site were: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, total DDT, alpha-chlordane, arsenic, copper, lead, mercury, 14 individual PAHs, and total PAHs.

The next step of the post-interim remedy construction risk evaluation evaluated potential risks by sediment COPCs. Concentrations of PAHs, pesticides, and metals in marsh samples south of the causeway were low relative to ESVs and/or background/typical facility concentrations in sediment. PCBs were not detected in any marsh samples south of the causeway. Based on the analyses of samples collected from the marsh area south of the causeway in October 2001, site-related concentrations of COPCs pose minimal risk to benthic invertebrates.

Sediment concentrations of PAHs and most metals in 3rd Battalion Pond Side Area 1 pose negligible potential risks to benthic invertebrates. Concentrations of mercury pose negligible or minor risk to benthic invertebrates in a single sample in 3rd Battalion Pond Side Area 1. Concentrations of metals in sediments from 3rd Battalion Pond Side Area 2 were low relative to ESVs and/or background/typical facility concentrations in sediment. Although potential site-related risk from copper and lead in the vicinity of SD-50 cannot be totally ruled out, potential risks appear to be minor. Concentrations of pesticides and metals in sediment from 3rd Battalion Pond Side Area 3 were low relative to ESVs and/or background/typical facility concentrations in sediment, and pose negligible site-related risks to benthic invertebrates. Pesticides in 3rd Battalion Pond Side Area 4 sediment is not believed to be due to wastes from the former causeway landfill, and are probably due to historical use at MCRD Parris Island. Any potential risks due to chlordane, 4,4'-DDT, and 4,4'-DDT isomers in 3rd Battalion Pond Side Area 4 are similar to potential risks posed by these pesticides from previous use throughout the base. Although adverse mercury-related biological effects in 3rd Battalion Pond Side Area 4 cannot be ruled out, the low concentrations suggest that potential risk is minor.

Data from all five areas were combined to calculate risks for the entire site. Because of the overall low PAH concentrations, potential risk posed by these compounds is negligible. The available data indicate that the presence of pesticides at the concentrations measured in 2001 and 2003 are not due to wastes from the former causeway landfill, but instead are probably due to historical use at MCRD Parris Island.

Arsenic, copper, lead, and mercury were selected as COPCs; however average concentrations of arsenic, copper, lead, and mercury were less than their respective background values. The data from Site 3 indicate that the presence of these metals at the concentrations measured in 2001 and 2003 are probably not due to landfill wastes and instead are a result of local or regional conditions.

No major sources of uncertainty, other than those typically associated with risk assessment calculations, were identified for the Site 3 ERA.

2.7.3 Basis for Action

Based on the 1999 RFI/RI, unacceptable risks were estimated for fishermen from fish ingestion due to pesticides, carcinogenic PAHs, PCBs, arsenic and mercury. Unacceptable risks were calculated for ecological receptors exposed to soil at Site 3 due to benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, arsenic, lead, mercury, and zinc. The IROD documented the decision to undertake an interim remediation action to address the unacceptable risks from soil and more highly contaminated sediment.

Although pre-IRA sediment concentrations indicated potential ecological risk, analysis of sediment after the IRA showed that chemical concentrations continue to decrease. After evaluation of the data, the determination was made that no unacceptable human health risk or ecological risks remained in the sediment at the 3rd Battalion Pond other than that generated by fish consumption (to be addressed by LUCs). The evaluation of surface water samples collected during the RFI/RI investigation was reviewed in the Technical Memorandum Post-Interim Construction Risk Assessment Site 3 – Causeway Landfill (Tetra Tech, 2010), and results indicated that human health and ecological risks posed by surface water COPCs were negligible, other than those generated by fish consumption (to be addressed by LUCs). The interim remedy, which included capping waste on the landfill and adjacent sediments, was designed to prevent migration of contaminants to the sediment and surface water. Therefore, a determination was made that no active remediation of sediment or surface water is necessary (Tetra Tech, 2010). Thus, the Navy has proposed No Action for sediment and surface water.

As a condition of the IROD, post-interim remedy construction human health and ecological risk assessments were performed. Based on the post-interim construction risk assessment, potential unacceptable risks exist to adult subsistence fishermen, child subsistence fishermen, child recreational fishermen, adult recreational fishermen (military and civilian) and EPA Region 4 default adult recreational fishermen due to dioxin-like PCBs, mercury, and 4,4-DDT. A response action is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment that may present an imminent and substantial endangerment to public health or welfare.

2.8 REMEDIAL ACTION OBJECTIVES

RAOs are medium-specific goals that define the objective of conducting remedial actions to protect human health and the environment. RAOs specify the COCs, potential exposure routes and receptors, and acceptable concentrations (i.e., cleanup levels) for a site and provide a general description of what the cleanup will accomplish. RAOs typically serve as the design basis for the remedial alternatives described in Section 2.9. The IROD developed several interim RAOs that included:

- Control human exposure (the existing maintenance worker, the future construction worker, and the recreational user) to COCs in surface soil at concentrations greater than remedial goal options (RGOs).
- Control exposure of ecological receptors to COCs in surface soil at concentrations greater than RGOs.
- Eliminate the migration of COCs from the fill material to sediment, surface water, and groundwater.
- Comply with chemical-specific, location-specific, and action-specific federal and state Applicable or Relevant and Appropriate Requirements (ARARs).

Additionally, the following RAO and LUC Objectives were developed since the implementation of the IROD:

RAO

- Control human exposure to COCs via fish consumption.

LUC Objectives

Consistent with the RAOs developed for the site, the specific performance objectives for the LUCs that have or will be implemented at Site 3 are as follows:

- To prohibit residential, commercial, agricultural and recreational use (including wading, swimming, and fishing) of the site. Prohibited residential uses shall include, but are not limited to, any form of housing, child-care facilities, schools, or playgrounds.
- To prevent unauthorized excavation, construction, or intrusive activities that would compromise the integrity of the Causeway landfill cover system, unless a construction plan is submitted and approved by Navy, EPA, and SCDHEC prior to initiating the work.
- To prohibit disturbance of the covered sediment areas in the 3rd Battalion Pond.
- To prohibit the extraction or any use of groundwater beneath the site.
- To prevent ingestion of contaminants in fish tissue.
- To maintain the integrity of the landfill cover system, as well as, any existing or future monitoring system such as the groundwater wells.

The interim RAOs identified in the IROD have been met by the construction and maintenance of the landfill cap as well as the implementation of LUCs. These conditions have been evaluated in the post-interim construction risk assessment. Therefore, these RAOs are being adopted as the final RAOs. An

action in the form of a modified LUC is being taken to address the control of human exposure to COCs via fish consumption. These RAOs are based on current and reasonably anticipated future commercial/industrial land uses for Site 3.

2.9 DESCRIPTION OF ALTERNATIVES

The Feasibility Study/Corrective Measures Study and the Proposed Plan for Soil IRA at Site 3 presented the alternatives listed in Table 2-4. Although the IRA has been completed, the table below reflects the alternatives as they were presented in the FS (Tetra Tech, 2000) and Proposed Plan for the Interim Remediation Action (Tetra Tech, 2000).

TABLE 2-4. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED

ALTERNATIVE	COMPONENTS	DETAILS	COST
Alternative 1 - No Action *No action to address contaminated soil and sediment and no use restrictions*	None	No action	No cost
Alternative 2a - Partial Containment	Soil Cover	Soil cover over one-half the length of the causeway (southeastern half). Soil depth above the waste would be a minimum of 2 feet. Placement of 1-foot soil cover over areas where surface soil exceeded cleanup levels.	**Capital**: $4,094,000 **30-Year NPW of O&M Cost**: **$55,400 - $71,400** **30-Year NPW**: **$4,835,000** **Time Frame**: 1 Year
	Slope Stabilization and Erosion Controls	Providing rip-rap or gabions at the toe of the slope to function as a toe fill buttress. Providing a vegetated cover, erosion control matting, gabions, and/or rip-rap on the causeway landfill to control erosion. Grass would be planted on the flatter plateau on the side slopes as required to control erosion.	
	LUCs and Long-Term Monitoring	Site restrictions to prohibit unauthorized intrusive activity within causeway or use of groundwater as drinking water. Warning signs associated with excessive fish ingestion and contact with sediment would be posted, and existing "No Swimming/Wading" signs would be maintained. Annual sediment and groundwater sampling would be performed. Re-evaluation of site conditions every 5 years to determine necessary changes to LUCs and monitoring.	
Alternative 2b -Full Containment	Soil Cover	Soil cover over entire length of the causeway. Soil depth above the waste would be a minimum of 2 feet. 1-foot soil cover would be placed over areas where surface soil exceed RGOs.	**Capital**: $4,527,000 **30-Year NPW of O&M Cost**: $55,400 - $71,400 30-Year NPW: $5,267,000 **Time Frame**: 1 Year
	Slope Stabilization and Erosion controls	Identical to slope stabilization and erosion controls for the partial containment alternative.	
	LUCs and Long-Term Monitoring	Identical to LUCs and long-term monitoring for the partial containment alternative.	
Alternative 3a - Partial	Soil Cover	Identical to soil cover for the partial	**Capital**: $4,160,000

TABLE 2-4. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED

ALTERNATIVE	COMPONENTS	DETAILS	COST
Containment with Further Sediment Evaluation		containment alternative.	**30-Year NPW of O&M Cost**: $55,400 - $71,400 30-Year NPW: $4,901,000 **Time Frame**: 1 Year
	Slope Stabilization and Erosion Control	Identical to slope stabilization and erosion control for the partial containment alternative.	
	Further Sediment Evaluation	Delineation of sediment on the pond side of the causeway after installation of slope stabilization and erosion control measures in the "hot spot" areas.	
	LUCs and Long-Term Monitoring	Identical to LUCs and long-term monitoring for the partial containment alternative.	
Modified Alternative 3a - Modified Partial Containment with Further Sediment Evaluation	Soil Cover	Modification of soil cover for partial containment to include 1-foot of soil cover over soils that present a moderate risk to ecological receptors in lieu of only addressing high-risk soils.	**Capital**: $4,722,000 **30-Year NPW of O&M Cost**: $58,700 - $74,700 **30-Year NPW: $5,500,000** **Time Frame**: 1.5 Years
	Slope Stabilization and Erosion Control	Identical to slope stabilization and erosion controls for partial containment alternative.	
	Further Sediment Evaluation	Identical to further sediment evaluation for partial containment with further sediment evaluation alternative.	
	LUCs and Long-Term Monitoring	Identical to LUCs and long-term monitoring for partial containment alternative.	
Alternative 3b - Full Containment with Further Sediment Evaluation	Soil Cover	Identical to soil cover for full containment alternative.	**Capital**: $4,652,000 **30-Year NPW of O&M Cost**: $55,400 - $71,400 **30-Year NPW: $5,392,000** **Time Frame**: 1 Year
	Slope Stabilization and Erosion controls	Identical to slope stabilization and erosion controls for partial containment alternative.	
	Further Sediment Evaluation	Identical to further sediment evaluation for partial containment with further sediment evaluation alternative.	
	LUCs and Long-Term Monitoring	Identical to LUCs and long-term monitoring for partial containment alternative.	

2.10 COMPARATIVE ANALYSIS OF ALTERNATIVES

In the FS (Tetra Tech, 2000) and Proposed Plan for the IRA (Tetra Tech, 2000), each alternative was evaluated against the nine NCP evaluation criteria. The Navy did not undertake another FS for the development of the final remedy, since the FFA parties agreed that the interim remedy should largely be adopted as the final remedy. Although the IRA has been completed, this section includes a summary comparison of the modified 3a Alternative, the Preferred Alternative, to the nine NCP Criteria.

- The Modified 3a alternative sufficiently protects human health and the environment by providing equal protection to maintenance and construction workers to the other containment alternatives and ranking in the middle of the containment alternatives for overall protectiveness of terrestrial wildlife.
- The Modified 3a alternative will comply or attain all chemical-, location- and action-specific ARARs/media clean-up standards in the long term.
- The Modified 3a alternative provides long-term effectiveness by including remedial components for preventing the migration of wastes.

- The Modified 3a alternative or other containment alternatives do not reduce the toxicity, mobility, or volume of the surface soil COCs other than any reduction that would result from biodegradation, natural dispersion, dilution, or other attenuating factors. The Presumptive Remedy for CERCLA Municipal Landfill Sites (U.S. EPA, 1993) establishes containment as the presumptive remedy for landfills similar in nature to Site/SWMU3 because the volume and type of the waste in municipal landfills generally make treatment impracticable.
- Implementation of the Modified 3a alternative mitigated disturbances to the adjacent wetlands during bank stabilization, and therefore, provides short-term effectiveness.
- The implementation of the modified 3a Alternative was technically and administratively feasible.
- The cost of the modified 3a Alternative was comparable with the other containment alternatives.
- State acceptance was achieved by SCDHEC concurrence with interim proposed remedy.
- Community acceptance was determined based on comments received during the public comment period for the Proposed Plan (Tetra Tech, 2000).

2.11 PRINCIPAL THREAT WASTE

The NCP at 40 Code of Federal Regulations (CFR) 300.430(a)(1)(iii)(A) establishes an expectation that treatment will be used to address the principal threats posed by a site wherever practicable. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or that would present a significant risk to human health or the environment should exposure occur. A source material is a material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air, or acts as a source for direct exposure. At Site 3, the contaminant concentrations are not highly toxic or highly mobile; therefore, principal threat wastes are not present at the site.

2.12 SELECTED REMEDY

2.12.1 Rationale for Selected Remedy

After careful consideration and investigation, the Navy's recommended final remedy for Site 3, as described further in Section 2.12.2 below and as presented in a second CERCLA Proposed Plan for Site 3 made available for public review and comment in February 2011, is a variation of modified Alternative 3a. Modified Alternative 3a was recommended because it would meet all established RAOs for the following reasons:

- Minimize human and ecological exposures to impacted surface soils where concentrations of contaminants represent a human health ILCR greater than 1×10^{-6} or moderate risk to terrestrial wildlife.
- Provides a minimum of 2 feet of soil cover over existing waste materials within the causeway structure, making it consistent with federal and South Carolina regulations.
- Stabilizes the sides of the causeway, eliminating further impact to the soils and sediments of the site.
- Fishing is prohibited to prevent human exposure due to fish consumption.

The U.S. EPA and SCDHEC concurred with the final remedy selected by the Navy. It satisfies the statutory requirements in CERCLA Section 121(b), which states that the selected alternative be protective of human health and the environment, complies with ARARs, be cost-effective, utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and does not satisfy the statutory preference for treatment as a principle element since the presumptive remedy of containment was implemented.

2.12.2 Description of Selected Remedy

The specific components of the selected final remedy for Site 3 are as follows:

- **Adoption of the Interim Remedial Action as Final (with modifications)**. The combined fill dirt, asphalt, cover fabric, rip-rap, and vegetative cover placed on site are successfully precluding unacceptable human and ecological exposures from capped wastes, surface soils, and sediments. Therefore, the interim remedy which has been adopted as final continues to satisfy the threshold criteria as required by CERCLA Section 121 and the NCP. MCRD will continue to visually monitor landfill cap integrity and collect and analyze landfill leachate samples to assess landfill integrity as well. The final remedy also adopts certain previously implemented LUCs with certain modification and additions, as a remedy component for surface soils and sediments as described below.
- **No Action for Sediments**. Although pre-IRA sediment concentrations indicated potential ecological risks, analysis of sediment after the IRA showed that chemical concentrations continued to decrease. These investigations conducted since completion of the landfill's cover system demonstrate that there are no unacceptable human or ecological risks associated with residual contamination found in Sediment Areas 1,2,3, and 4 other than that generated by fish consumption (to be addressed by LUCs).
- **No Action for Surface Water**. The Site 3 FS determined that capping of wastes, surface soils, and sediments should contain the source(s) of surface water contamination, which should result in a decrease in concentration of the contaminants in the surface water. No site-related risks to human health or the environment from surface water were identified during the RFI/RI and no risks should occur other than those generated by fish consumption (to be addressed by LUCs). Therefore, no additional remedy has been selected for surface water.
- **Maintenance of the Landfill Cover**. Maintenance of the landfill cover system (soil cover, geotextile, rip-rap, culverts) including related structural remedy components (monitoring wells, etc.) will be implemented as shall be agreed upon in a post-ROD Remedial Design document to be developed by the Navy in accordance with the FFA for review and approval by EPA and SCDHEC. Any erosion will be mitigated and measures such as removing woody vegetation will be implemented to ensure landfill integrity.
- **Modification of Land Use Control Signage**. The Navy will modify one of the LUCs previously applied to the site. This control (posted signs) should preclude potential unacceptable human health exposure to known contamination in fish present in the 3rd Battalion Pond. Current signage on the two piers at 3rd Battalion Pond states, "Notice: No Subsistence Fishing" will be replaced with signs that prohibit all fishing. Additional information will also be made available by the MCRD should any questions be received from the public about the new signage.
- **Addition of Administrative Land Use Controls.** The Site 3 location and LUC boundaries, prohibitions against unauthorized excavation, construction, or intrusive activities, fishing at the 3rd Battalion Pond, residential development or groundwater extraction or use (except as directed by SCDHEC or EPA for monitoring wells), and the requirement for MCRD environmental department approval of any such activities will be annotated in the installation's Environmental Management System. The Marine Corp's Environmental Management System (EMS) contains information about Site 3, such as: location, LUC boundaries, prohibitions against unauthorized excavation, construction, or intrusive activities, fishing restrictions at 3rd Battalion Pond residential development, groundwater extraction or use, and the requirement for MCRD Natural Resources and Environmental Affairs Office approval of such activities. Information about Site 3 is updated in EMS as it becomes available. The EMS is a centralized tool for the dissemination of information critical to making appropriate decisions regarding the management of resources, compliance with environmental regulations and ensuring compliance with site-specific use limitations. This will include updating the Base Master Plan, installation's geographical information system and any deed/lease restrictions in the event of property transfer. Site 3 LUCs will be included in a Depot Order currently under development governing ground disturbing activities across the facility.

LUCs will be maintained until the concentrations of hazardous substances in the affected media (soil, sediments, and fish) are at such levels to allow for unrestricted use and unlimited exposure. Although the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity. The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs. A LUC Remedial Design (RD), as part of the Final RD or document memorializing Remedial Action Completion

(primary documents under the FFA), that addresses how these LUCs will be implemented, maintained, monitored (including periodic inspections), enforced and reported on, will be prepared and submitted by the Navy per the approved SMP schedule to EPA and SCDHEC for review and approval. Once the Final RD or document memorializing Remedial Action Completion (including the LUC RD) is approved by EPA and SCDHEC, it shall supersede any Land Use Control Implementation Plan (LUCIP) already developed for Site 3, as well as any conditions related to Site 3 LUCs in the LUC Memorandum of Agreement (also termed the Land Use Control Assurance Plan) executed between the Navy, EPA, and SCDHEC. As the actual LUCs are somewhat different than those stated in the LUCIP, the LUCIP will be superseded by the LUC RD after issuance of the final ROD.

FIGURE 2-4. SITE 3 LAND USE CONTROL BOUNDARY

2.12.3 Expected Outcomes of Selected Remedy

The current non-residential land use, which will be supported by the Selected Remedy, is expected to continue at Site 3, and there are no other planned land uses in the foreseeable future. There are no socio-economic, community revitalization, or economic impacts or benefits associated with implementation of the Selected Remedy. The RAOs for Site 3 have been achieved. Table 2-5 describes how the Selected Remedy mitigates risk and achieves RAOs for Site 3.

TABLE 2-5. HOW SELECTED REMEDY MITIGATES RISK AND ACHIEVES RAOS

RISK	RAO	COMMENTS
Direct exposure to and ingestion of contaminated soil and sediment and ingestion of fish	Minimize human and ecological exposures to impacted surface soil where concentrations of contaminants represent a human health ILCR greater than 1 x 10-6 or moderate risk to terrestrial wildlife. Minimize human health and ecological exposure to impacted sediment.	A cover over contaminated soil and sediment will prevent human and ecological exposure to contaminated soil and sediment. LUCs will prevent human exposures to contaminants in fish tissue and sediment and surface water through the banning of fishing, wading, and swimming.

Because the current non-residential use of the site is expected to continue for the foreseeable future, it is not expected that modification or removal of the LUCs will be required. However, if proposed land use changes in the future and uses other than industrial/commercial-type activities are expected, additional excavation or other remedial approaches may be required. Any modifications to LUCs will be conducted in accordance with provisions in the Site 3 LUC RD, CERCLA, and the NCP.

2.13 STATUTORY DETERMINATIONS

Remedial actions undertaken at National Priorities List (NPL) sites must meet the statutory requirements of Section 121 of CERCLA and thereby achieve adequate protection of human health and the environment, comply with ARARs of both federal and state laws and regulations, be cost-effective, and use, to the maximum extent practicable, permanent solutions and alternative treatment or resource recovery technologies. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, and/or mobility of hazardous waste as the principal element. The following discussion summarizes the statutory requirements that are met by the Selected Remedy.

- **Protection of Human Health and the Environment -** The combined fill dirt, asphalt, cover fabric, rip-rap, and vegetative cover placed on the site is successfully precluding unacceptable human and ecological exposures from capped wastes, surface soil, sediment, and fish concentrations. LUCs will prevent human exposure to contaminants in fish tissue and sediment and surface water through the banning of fishing, wading, or swimming.
- **Compliance with ARARs –** Section 121(d) of CERCLA, as amended, specifies, in part, that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are applicable or relevant and appropriate (*i.e.*, ARARs) to the hazardous substances or particular circumstances at a site or obtain a waiver. *See also* 40 C.F.R. § 300.430(f)(1)(ii)(B). ARARs include only federal and state environmental or facility siting laws/regulations and do not include occupational safety or worker protection requirements. In addition to ARARs, the lead and support agencies may, as appropriate, identify other advisories, criteria, or guidance to be considered for a particular release. The "to-be-considered" (TBC) category consists of advisories, criteria, or guidance that were developed by EPA, other federal agencies, or states that may be useful in developing CERCLA remedies. *See* 40 C.F.R. § 300.400(g)(3).

Applicable requirements, as defined in 40 C.F.R. § 300.5, means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site. Only those state standards that are identified by the state in a timely manner and that are more stringent than federal requirements may be applicable. *Relevant and appropriate requirements,* as defined in 40 C.F.R. § 300.5, means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site. Only those state standards that are identified by the state in a timely manner and that are more stringent than federal requirements may be relevant and appropriate.

In accordance with 40 C.F.R. § 300.400(g), the Navy, EPA and SCDHEC have identified the ARARs and TBCs for the selected remedy. The selected remedy is expected to attain the identified federal and State ARARs listed in Appendix A

- **Cost-Effectiveness** – The Selected Remedy is the most cost-effective alternative that allows for continued non-residential use of the property and represents the most reasonable value for the money. The costs are proportional to overall effectiveness by achieving an adequate amount of long-term effectiveness and permanence within a reasonable time frame. Detailed costs for the Selected Remedy are presented in Appendix B.
- **Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable** – The Selected Remedy represents the maximum extent to which permanent solutions and alternative treatment technologies can be used in a practical manner at Site 3. Based on the type and volume of contamination and the current and reasonably anticipated future use of the site, no treatment alternatives were evaluated for Site 3 in the FS (Tetra Tech, 2000). Soil caps and LUCs to achieve the cleanup level provide the best balance of tradeoffs for long-term effectiveness and permanence with ease of implementation for reasonable cost.
- **Preference for Treatment as a Principal Element** – Treatment is not a principal element of the Selected Remedy for soil, sediment, and fish at Site 3 because there are no principal threat wastes at the site, and soil caps and LUCs provide the best balance of tradeoffs with respect to long-term effectiveness and permanence at a reasonable cost.
- **Five-Year Review Requirement** – Because hazardous substances will remain at the site above levels that allow for unlimited exposure and unrestricted use, the Navy will review the final remedial action no less than every five (5) years, per CERCLA Section 121(c) and the NCP at 40 C.F.R. § 300.430f(4)(ii). If results of the five-year reviews reveal that remedy integrity is compromised and protection of human health is insufficient, then additional remedial actions will be evaluated by the Navy, EPA, and SCDHEC.

2.14 Documentation of Significant Changes

CERCLA Section 117(b) requires an explanation of significant changes from the selected remedy presented in the Proposed Plan that was published for public comment. Comments were received during the public information session held March 15, 2011. No significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate. The comments raised at the public meeting and responses are provided in Section 3.0, Responsiveness Summary.

3.0 RESPONSIVENESS SUMMARY

3.1 STAKEHOLDER COMMENTS AND LEAD AGENCY RESPONSES

Comments were received during the public comment period (February 25, 2011 to April 25, 2011); comments and the Navy's responses are in Table 3-1. The Navy held a public meeting on March 15, 2011; the U.S. EPA and SCDHEC participated in the meeting. A transcript of the meeting is available in the administrative record.

TABLE 3-1. SUMMARY OF COMMENTS FROM PUBLIC COMMENT PERIOD

COMMENT	RESPONSE
Robert Freeman stated that the public comment period ends on April 25 and the public meeting was scheduled for March 15 but the decision to prohibit fishing in 3rd Battalion Pond was taken in 2010 and posted on March 1, 2011. This sends a message that public comments are not needed or wanted, "The decision has been made."	Once potential risks resulting from fish consumption were identified, MCRD acted proactively to prevent consumption of fish from 3rd Battalion Pond. The public comment period provides the opportunity for the public to provide data or information to the Navy, MCDR Parris Island, EPA and SCDHEC that would justify removing the fishing prohibitions; such data or information was not received.
Robert Freeman submitted a petition signed by approximately 3 dozen of the Parris Island Rod & Gun Club members expressing their opposition to prohibiting fishing in the 3rd Battalion Pond.	The decision is a precautionary measure based on the uncertainty in continuing to eat fish caught off the side of a CERCLA landfill. The decision is based on conservative risk calculations. The uncertainty justifies the decision and ensures that no one is exposed to any risk, no matter how remote, from eating 3rd Battalion Pond fish.
Reed S. Armstrong from the Coastal Conservation League stated that the results from studies conducted at Site 3 support Modified Alternative 3a as the best option for final remediation action at this site. He asked that consideration be given to imposing weight limits for traffic using the causeway to ensure that the integrity of the pavement and cover over the contaminated soil is not compromised.	The 3rd Battalion Causeway is currently the truck route onto Parris Island. Routing commercial truck traffic across Site 3 is necessary to reduce the conflict between recruit training and vehicular traffic. The causeway is inspected quarterly to ensure the integrity of the cover. The effects of traffic on the causeway integrity will be considered.
J.R. Beasley from Maggioni Seafood asked that the overfill overflow of the waste that flows periodically into the Beaufort waterways that cause closure of the shellfish grounds be corrected and that there should be compensation to the local fishermen when these waterways are closed or correct the problem so it will not happen in any conditions including hurricanes.	The unfortunate situation described does not have any discernable cause related to Site 3. The integrity of the causeway is inspected quarterly and groundwater/leachate is sampled semi-annually. The causeway was reinforced for wave action from 100 mph winds; reinforcement was accomplished through the use of fabriform, gabions and rip-rap.
Bill Major would like the pond to remain open to catch-and-release boating activity.	The mission of the Marine Corps Recruit Depot at Parris Island is to "Make Marines." In accordance with the Sikes Act, the Depot is obligated to make natural resources available for recreation, as long as, that availability is consistent with safety and military security considerations. The Depot is staffed and funded sufficient to provide basic training to Marines. In order to allow for continued recreation at the 3rd Battalion Pond, including catch-and-release fishing and kayaking/canoeing, sufficient controls would have to be in place to prevent users from taking fish for consumption. The resources to provide those controls do not currently exist; therefore, the Depot is not able to meet the safety obligation of the Sikes Act and must close the pond to recreational activities. If the availability of resources to prevent recreational users from taking fish for consumption change, the Depot may reconsider the decision

TABLE 3-1. SUMMARY OF COMMENTS FROM PUBLIC COMMENT PERIOD	
COMMENT	**RESPONSE**
	allowing catch and release and/or boating activities provided the activities can be conducted while ensuring no fish are consumed.
Rand Ward respects the intent to protect people's health. It is still a resource to take people's children canoeing and kayaking. He would like to see it remain open to canoeing and kayaking, if not fishing.	The mission of the Marine Corps Recruit Depot at Parris Island is to "Make Marines." In accordance with the Sikes Act, the Depot is obligated to make natural resources available for recreation, as long as, that availability is consistent with safety and military security considerations. The Depot is staffed and funded sufficient to provide basic training to Marines. In order to allow for continued recreation at the 3rd Battalion Pond, including catch-and-release fishing and kayaking/canoeing, sufficient controls would have to be in place to prevent users from taking fish for consumption. The resources to provide those controls do not currently exist; therefore, the Depot is not able to meet the safety obligation of the Sikes Act and must close the pond to recreational activities. If the availability of resources to prevent recreational users from taking fish for consumption change, the Depot may reconsider the decision allowing catch and release and/or boating activities provided the activities can be conducted while ensuring no fish are consumed.
Jack Kelling stated that it is a shame to close the pond entirely because of the trophy fish in the pond. It is also nice to kayak there because it is sheltered water.	The mission of the Marine Corps Recruit Depot at Parris Island is to "Make Marines." In accordance with the Sikes Act, the Depot is obligated to make natural resources available for recreation, as long as, that availability is consistent with safety and military security considerations. The Depot is staffed and funded sufficient to provide basic training to Marines. In order to allow for continued recreation at the 3rd Battalion Pond, including catch-and-release fishing and kayaking/canoeing, sufficient controls would have to be in place to prevent users from taking fish for consumption. The resources to provide those controls do not currently exist; therefore, the Depot is not able to meet the safety obligation of the Sikes Act and must close the pond to recreational activities. If the availability of resources to prevent recreational users from taking fish for consumption change, the Depot may reconsider the decision allowing catch and release and/or boating activities provided the activities can be conducted while ensuring no fish are consumed.
Leonard Barnes stated that once MCRD Parris Island has informed people of the risk of consuming fish from 3rd Battalion Pond, the decision to incur that risk should be put on the people.	The decision is a precautionary measure taken by the Commanding General of MCRD Parris Island to ensure protection of health for local residents based on concerns associated with the uncertainty of fishing in a semi-enclosed body of water adjacent to a landfill. There are nine criteria the selected remedy must be evaluated against. The first criterion is the selected remedy MUST provide "Overall Protectiveness of Human Health and the Environment". In order to satisfy the criterion to protect human health and the environment, the final remedy must eliminate, reduce, or control threats to public health and the environment. The Navy has chosen to protect public health by eliminating consumption of fish from 3rd Battalion Pond.
Charles Maguire stated that as the tide rises and falls the water comes in, the water goes out [of 3rd Battalion Pond]. So the contaminated water in the pond and sediments also go out to Archer Creek and all the other creeks surrounding the	The purpose of the Interim Remedial Action (IRA) taken in 2001 was to contain any contamination associated with the causeway landfill in order to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. To that end,

TABLE 3-1. SUMMARY OF COMMENTS FROM PUBLIC COMMENT PERIOD	
COMMENT	**RESPONSE**
pond. So if the pond is contaminated, the areas around it has got to be contaminated.	the following steps were taken: -A soil cover was installed over the top and sides of the causeway. -The side slopes were stabilized and erosion controls were installed over the length of the causeway. -Covers were installed over four areas of sediment in the 3rd Battalion Pond. Although pre-IRA sediment concentrations indicated potential ecological risks, analysis of sediment after the IRA demonstrate that there are no unacceptable human or ecological risks associated with the sediment areas. No site-related risks to human health or the environment from surface water were identified during the investigation of the site. As a result of the actions taken to protect human health and the environment the areas surrounding the pond are also protected.

3.2 TECHNICAL AND LEGAL ISSUES

No technical or legal issues associated with the Site 3 ROD were identified.

ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chemical of concern
COPC	chemical of potential concern
CSF	cancer slope factor
CSM	conceptual site model
EMS	Environmental Management System
EPA	United States Environmental Protection Agency
EPC	exposure point concentration
ERA	ecological risk assessment
ER, N	Environmental Restoration, Navy
ESV	Ecological Screening Value
FFA	Federal Facility Agreement
FS	Feasibility Study
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IAS	Initial Assessment Study
ILCR	incremental lifetime cancer risk
IR	Installation Restoration
IRA	Interim Remedial Action
IROD	Interim Record of Decision
LOAEL	low-observed-adverse-effects level
LUC	land use control
MCRD	Marine Corps Recruit Depot
MRP	Munitions Response Program
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAEL	no-observed-adverse-effects level
NPL	National Priorities List
NPW	net present worth
O&M	operation and maintenance
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
RAO	Remedial Action Objective

RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RfD	reference dose
RFI	RCRA Facilities Investigation
GRO	Remedial Goal Options
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCDHEC	South Carolina Department of Health and Environmental Control
SI	Site Investigation
SMP	Site Management Plan
TBC	to be considered
TRV	toxicity reference value
Tetra Tech	Tetra Tech NUS, Inc.
UCL	Upper Confidence Limit
US	United States
UST	Underground Storage Tank
VOC	volatile organic compound
VS	Verification Step

REFERENCES

Tetra Tech 2000. Final Feasibility/Corrective Measures Study for Site3/SWMU 3 – Causeway Landfill, MCRD Parris Island, South Carolina, November.

Tetra Tech, 2010. Technical Memorandum Post-Interim Construction Risk Assessment Site 3 – Causeway Landfill, MCRD Parris Island, South Carolina. July

U.S. EPA, 1993. Presumptive Remedy for CERCLA Municipal Landfill Sites. EPA 540-F-93-035, Office of Solid Waste and Emergency Response, Washington D.C.

Administrative Record Reference Table

DETAILED ADMINISTRATIVE RECORD REFERENCE TABLE

ITEM	REFERENCE PHRASE IN ROD	LOCATION IN ROD	LOCATION OF INFORMATION IN ADMINISTRATIVE RECORD
1	**Eight shallow Soil/sediment samples and eight surface water samples**	Table 2-1	McClelland Consultants, 1990. Remedial Investigation Verification Step. Southern Division Naval Facilities Engineering Command, Charleston, South Carolina, May. Section 3.6 and Figure 3.6-1.
2	**consumption of fish**	Table 2-1	ABB Environmental, 1993. Extended Site Investigation Report Causeway Landfill. Southern Division Naval Facilities Engineering Command, North Charleston, South Carolina, August. Sections 3 and 4, Figures 1-3, 3-1 and 3-2. Tables 3-1 and 4-1 through 4-7.
3	**16 surface soil samples, 5 subsurface soil samples, 20 surface water samples, 21 sediment samples and 4 groundwater samples**	Table 2-1	Tetra Tech, 1999. RCRA Facilities Investigation / Remedial Investigation for Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, North Charleston, South Carolina, November. Tables 3-3, 3-4, 3-6, 3-7 and 3-8.
4	**the risk posed by the waste materials**	Table 2-1	Tetra Tech, 2000. Interim Soil Record of Decision Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, North Charleston, South Carolina, July. Section 2.7.
5	**Placement of a protective cover**	Table 2-1	Tetra Tech, 2000. Interim Soil Record of Decision Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, North Charleston, South Carolina, July. Section 2.9.
6	**Stabilization of both of the causeway's banks**	Table 2-1	Tetra Tech, 2000. Interim Soil Record of Decision Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, North Charleston, South Carolina, July. Section 2.9.
7	**Construction of a paved road**	Table 2-1	Tetra Tech, 2000. Interim Soil Record of Decision Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, North Charleston, South Carolina, July. Section 2.9.
8	**Covering the four areas of contaminated sediment**	Table 2-1	Tetra Tech, 2000. Interim Soil Record of Decision Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, North Charleston, South Carolina, July. Section 2.9.
9	**Re-characterization of sediment**	Table 2-1	Tetra Tech, 2000. Interim Soil Record of Decision Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, North Charleston, South Carolina, July. Section 2.9.
10	**Implementation of land use controls**	Table 2-1	Tetra Tech, 2000. Interim Soil Record of Decision Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, North Charleston, South Carolina, July. Section 2.9.
11	**Long-term monitoring**	Table 2-1	Tetra Tech, 2000. Interim Soil Record of Decision Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, North Charleston, South Carolina, July. Section 2.9.
12	**Twenty sediment samples**	Table 2-1	Tetra Tech, 2010. Technical Memorandum Post-Interim Construction Risk Assessment for Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, Jacksonville, Florida, July. Section 4.1, and Tables 5 and 7.
13	**The results of the 2003 sampling effort**	Table 2-1	Tetra Tech, 2010. Technical Memorandum Post-Interim Construction Risk Assessment for Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, Jacksonville, Florida, July. Section 4.2 and Table 10.
14	**Fish tissue**	Table 2-1	Tetra Tech, 2010. Technical Memorandum Post-Interim Construction Risk Assessment for Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, Jacksonville,

DETAILED ADMINISTRATIVE RECORD REFERENCE TABLE			
ITEM	REFERENCE PHRASE IN ROD	LOCATION IN ROD	LOCATION OF INFORMATION IN ADMINISTRATIVE RECORD
			Florida, July. Section 4.3, Tables 11, 13, and Figure 7.
15	**military recreational fisherman, civilian recreational fisherman, civilian subsistence fisherman, and standard U.S. EPA Region IV default fisherman**	Table 2-1	Tetra Tech, 2010. Technical Memorandum Post-Interim Construction Risk Assessment for Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, Jacksonville, Florida, July. Table 15.
16	**The human health risks**	Table 2-1	Tetra Tech, 2010. Technical Memorandum Post-Interim Construction Risk Assessment for Site 3 – Causeway Landfill. Naval Facilities Engineering Command Southeast, Jacksonville, Florida, July. Section 5, Tables 16, 17, 18A and 18B, and Figures 11 and 12.

Appendix A
ARARs

LIST OF ACTION-SPECIFIC ARARS/TBC
FOR SITE 3 AT MCRD, PARRIS ISLAND, SOUTH CAROLINA

Action	Requirements	Prerequisite	Citation
General Construction Standards — All Land-disturbing Activities (i.e., excavation, clearing, grading, etc.)			
Managing storm water runoff from land-disturbing activities	Must comply with the substantive requirements for stormwater management and sediment control of *NPDES General Permit No. SCR100000.*	Large and small construction activities (as defined in R. 61-9) of more than 1 acre of land – **applicable**	SCDHEC R. 61-9.122.41 SCDHEC R. 61-9.122.28 NPDES General Permit No. SCR100000
	The stormwater management and sediment control plan shall contain at a minimum the information provided in the following subsections:	Activities involving more than two (2) acres and less than five (5) acres of actual land disturbance which are not part of a larger common plan of development or sale – **applicable**	SCDHEC R. 72-307 I. – *South Carolina Storm Water Management and Sediment Reduction Regulations*
	A plan for temporary and permanent vegetative and structural erosion and sediment control measures which specify the erosion and sediment control measures to be used during all phases of the land disturbing activity and a description of their proposed operation;		SCDHEC R. 72-307 I.(3)(d)
	Provisions for stormwater runoff control during the land disturbing activity and during the life of the facility meeting the following requirements of subsections (e)1 and 2.		SCDHEC R. 72-307 I.(3)(e)
Managing fugitive dust emissions from land disturbing activities	Emissions of fugitive particulate matter shall be controlled in such a manner and to the degree that it does not create an undesirable level of air pollution. Volatile organic compounds shall not be used for dust control purposes. Oil treatment is also prohibited.	Activities that will generate fugitive particulate matter (Statewide) – **applicable**	SCDHEC R. 61-62.6 Section III(a)- *Control of Fugitive Particulate Matter Statewide* SCDHEC R. 61-62.6 Section III(d)

Action	Requirements	Prerequisite	Citation
Monitoring Well Installation, Operation, and Abandonment			
Installation or Abandonment of Permanent and Temporary Monitoring Wells.	All monitoring wells shall be drilled, constructed, maintained, operated, and/or abandoned to ensure that underground sources of drinking water are not contaminated.	Construction of permanent and temporary monitoring wells (including non-standard installation, as defined in R. 61-71B(2)) –**applicable**	SCDHEC R. 61-71H.1(b)
	Abandonment of permanent conventionally installed monitoring wells shall be by forced injection of grout or pouring through a tremie pipe starting at the bottom of the well and proceeding to the surface in one continuous operation. The well shall be filled with either with neat cement, bentonite-cement, or 20% high solids sodium bentonite grout, from the bottom of the well to the land surface.		SCDHEC R. 61-71H.2(e)
Waste Characterization and Storage — (e.g., excavated contaminated soils/sediments, debris)[1]			
Characterization of solid waste	Must determine if solid waste is a hazardous waste using the following method: Should first determine if waste is excluded from regulation under 40 CFR 261.4; and	Generation of solid waste as defined in 40 CFR 261.2 – **applicable**	40 CFR 262.11(a) SCDHEC R. 61-79 262.11*(a)*
	Must determine if waste is listed as hazardous waste under 40 CFR Part 261.	Generation of solid waste which is not excluded under 40 CFR 261.4(a) – **applicable**	40 CFR 262.11(b) SCDHEC R. 61-79 262.11*(b)*
	Must determine whether the waste is (characteristic waste) identified in subpart C of 40 CFR Part 261by either: (1) Testing the waste according to the methods set forth in subpart C of 40 CFR part 261, or according to an equivalent method approved by the Administrator under 40 CFR 260.21; or (2) Applying knowledge of the hazard characteristic of the waste in light of the materials or the processes used.	Generation of solid waste which is not excluded under 40 CFR 261.4(a) – **applicable**	40 CFR 262.11(c) SCDHEC R. 61-79 262.11*(c)*

LIST OF ACTION-SPECIFIC ARARS/TBC
FOR SITE 3 AT MCRD, PARRIS ISLAND, SOUTH CAROLINA

Action	Requirements	Prerequisite	Citation
	Must refer to Parts 261, 262, 264, 265, 266, 268, and 273 of Chapter 40 for possible exclusions or restrictions pertaining to management of the specific waste.	Generation of solid waste which is determined to be hazardous waste – **applicable**	40 CFR 262.11(d) SCDHEC R. 61-79 262.11*(d)*
Determinations for management of hazardous waste	Must determine each EPA Hazardous Waste Number (waste code) applicable to the waste in order to determine the applicable treatment standards under 40 CFR 268 *et seq.*. *Note:* This determination may be made concurrently with the hazardous waste determination required in Sec. 262.11 of this chapter.	Generation of hazardous waste for storage, treatment or disposal – **applicable**	40 CFR 268.9(a) SCDHEC R. 61-79 268.9*(a)*
	Must determine the underlying hazardous constituents [as defined in 40 CFR 268.2(i)] in the characteristic waste.	Generation of RCRA characteristic hazardous waste (and is not D001 non-wastewaters treated by CMBST, RORGS, or POLYM of Section 268.42 Table 1) for storage, treatment or disposal – **applicable**	40 CFR 268.9(a) SCDHEC R. 61-79 268.9*(a)*
	Must determine if the hazardous waste meets the treatment standards in 40 CFR 268.40, 268.45, or 268.49 by testing in accordance with prescribed methods or use of generator knowledge of waste. *Note:* This determination can be made concurrently with the hazardous waste determination required in 40 CFR 262.11.	Generation of hazardous waste for storage, treatment or disposal – **applicable**	40 CFR 268.7(a) SCDHEC R. 61-79 268.7*(a)* (1)

LIST OF ACTION-SPECIFIC ARARS/TBC
FOR SITE 3 AT MCRD, PARRIS ISLAND, SOUTH CAROLINA

Action	Requirements	Prerequisite	Citation
Temporary storage of hazardous waste in containers	A generator may accumulate hazardous waste at the facility provided that: • waste is placed in containers that comply with 40 CFR 265.171-173; and • the date upon which accumulation begins is clearly marked and visible for inspection on each container • container is marked with the words "hazardous waste"; or	Accumulation of RCRA hazardous waste on site as defined in 40 CFR 260.10 –**applicable**	40 CFR 262.34(a)(1) and (2) SCDHEC R. 61-79 262.34*(a)* (1) and (2) 40 CFR 264.34(a)(3) SCDHEC R. 61-79 262.34*(a)* (3)
	• container may be marked with other words that identify the contents.	Accumulation of 55 gal. or less of RCRA hazardous waste or 1 quart of acutely hazardous waste listed in 261.33(e) at or near any point of generation – **applicable**	40 CFR 262.34(c)(1) SCDHEC R. 61-79 262.34*(c)* (1)
Use and management of hazardous waste in containers	If container holding waste is not in good condition (e.g. severe rusting, structural defects), or if it begins to leak, must transfer waste into container in good condition.	Storage of RCRA hazardous waste in containers – **applicable**	40 CFR 265.171 SCDHEC R. 61-79 265.171
	Must use a container made or lined with materials which will not react with, and are otherwise compatible with, the hazardous waste to be stored, so that the ability of the container to contain the waste is not impaired.		40 CFR 265.172 SCDHEC R. 61-79 265.172
	A container holding hazardous waste must always be closed during storage, except when necessary to add or remove waste. A container holding hazardous waste must not be opened, handled, or stored in a manner which may rupture the container or cause it to leak.		40 CFR 265.173(a) and (b) SCDHEC R. 61-79 265.173*(a)* and *(b)*

Action	Requirements	Prerequisite	Citation
Storage of hazardous waste in container area	Area must have a containment system designed and operated in accordance with 40 CFR 265.175(b).	Storage of RCRA hazardous waste in containers ***with free liquids*** – **applicable**	40 CFR 264.175(a) SCDHEC R. 61-79 264.175*(a)*
	Area must be sloped or otherwise designed and operated to drain liquid from precipitation, or Containers must be elevated or otherwise protected from contact with accumulated liquid.	Storage of RCRA-hazardous waste in containers that ***do not contain free liquids*** (other than F020, F021, F022, F023, F026 and F027) – **applicable**	40 CFR 265.175(c)(1) and (2) SCDHEC R. 61-79 265.175*(c)* (1) and (2)
Temporary storage of solid waste	Shall be conducted in a manner to: a. Inhibit the harborage of flies, rodents, and other vectors; b. Prevent conditions for transmission of diseases to man or animals; c. Prevent blowing debris and particulates so as not to be injurious to human health and the environment; d. Prevent water pollution and prevent the escape of solid waste or leachate to waters of the State; and e. Minimize objectionable odors, dust, unsightliness, and aesthetically objectionable conditions, and prevent the accumulation of materials in an untidy and unsafe manner so as to become a fire and safety hazard.	Generation of solid waste for temporary storage prior to processing, disposal of that waste – **relevant and appropriate**	SCDHEC R. 61-107.5(C)(1) Note: Jurisdictional Authority under South Carolina Solid Waste Policy and Management Act of 1991 (§§ 44-96-10 et seq)
Waste treatment and disposal — (e.g., excavated contaminated soils/sediments, debris) [1]			
Disposal of solid waste	Shall ultimately dispose of solid waste at facilities and/or sites permitted or registered by the Department for processing or disposal of that waste stream.	Generation of solid waste intended for off-site disposal – **relevant and appropriate**	SCDHEC R. 61-107.5(D)(3)
Disposal of RCRA-hazardous waste in an off-site land-based unit	May be land disposed if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR 268.40 before land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA waste – **applicable**	40 CFR 268.40(a) SCDHEC R. 61-79 268.40*(a)*

Action	Requirements	Prerequisite	Citation
	All underlying hazardous constituents [as defined in 40 CFR 268.2(i)] must meet the Universal Treatment Standards, found in 40 CFR 268.48 Table UTS prior to land disposal.	Land disposal of restricted RCRA characteristic wastes (D001-D043) that are not managed in a wastewater treatment system that is regulated under the CWA, that is CWA equivalent, or that is injected into a Class I nonhazardous injection well – **applicable**	40 CFR 268.40(e) SCDHEC R. 61-79 268.40*(e)*
	Must be treated according to the alternative treatment standards of 40 CFR 268.49(c) or Must be treated according to the UTSs [specified in 40 CFR 268.48 Table UTS] applicable to the listed and/or characteristic waste contaminating the soil prior to land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted hazardous soils – **applicable**	40 CFR 268.49(b) SCDHEC R. 61-79 268.49*(b)*
	To determine whether a hazardous waste indentified in this section exceeds the applicable treatment standards of 40 CFR 268.40, the initial generator must test a sample of the waste extract or the entire waste, depending on whether the treatment standards are expressed as concentration in the waste extract or waste, or the generator may use knowledge of the waste. If the waste contains constituents (including UHCs in the characteristic wastes) in excess of the applicable UTS levels in 40 CFR 268.48, the waste is prohibited from land disposal, and all requirements of part 268 are applicable, except as otherwise specified.	Land disposal of RCRA toxicity characteristic wastes (D004-D011) that are newly identified (i.e., wastes, soil, or debris identified by the TCLP but not the Extraction Procedure) – **applicable**	40 CFR 268.34(f) SCDHEC R. 61-79 268.34*(f)*
Disposal of RCRA-*hazardous waste debris* in a land-based unit (i.e., landfill)	Must be treated prior to land disposal as provided in 40 CFR 268.45(a)(1)-(5) unless EPA determines under 40 CFR 261.3(f)(2) that the debris no longer contaminated with hazardous waste or the debris is treated to the waste-specific treatment standard provided in 40 CFR 268.40 for the waste contaminating the debris.	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA-hazardous debris – **applicable**	40 CFR 268.45(a) SCDHEC R. 61-79 268.45*(a)*

Action	Requirements	Prerequisite	Citation
	Post-closure care of landfill		
Maintenance of landfill cover (including riprap along base)	Maintain the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and prevent run-on and run-off from eroding or otherwise damaging the final cover.	Post-closure care of Class III landfill – **relevant and appropriate**	SCDHEC R. 61-107.19 Part V Subpart F 258.61(a)(1)
Post-closure groundwater monitoring	Monitor the groundwater in accordance with the requirements of Subpart E and maintaining the groundwater monitoring system. *Note:* Shallow groundwater and leachate within the boundaries of the landfill unit will be monitored according to long-term monitoring plan developed as part of the CERCLA response action for this site.	Post-closure care of Class III landfill – **relevant and appropriate**	SCDHEC R. 61-107.19 Part V Subpart F 258.61(a)(3)
	The length of the post-closure care period may be decreased if the permittee can provide technical rationale that the decreased post-closure care period is sufficient to protect human health and the environment. *Note:* Navy may as part of the CERCLA remedy review process (including Five-Year Review under Section 121(c)), seek SCHDEC and EPA approval of a modification to the monitoring period.		SCDHEC R. 61-107.19 Part V Subpart F 258.61(b)(2)

Action	Requirements	Prerequisite	Citation
Post-closure use of property	Post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other components of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements in this Part. Disturbance of the containment system may be approved if the permittee demonstrates that disturbance of the final cover, liner or other component of the containment system, including any removal of waste, will not increase the potential threat to human health or the environment. *Note:* MCRD and Navy are responsible for ensuring LUCs (as part of the CERCLA remedy) prevent unauthorized activities including disturbance of landfill cover integrity. EPA and SCDHEC approval is required in the event Navy/MCRD intends to disturb the cover (other than maintenance).	Post-closure care of Class III landfill – **relevant and appropriate**	SCDHEC R. 61-107.19 Part V Subpart F 258.61(c)(3)
Transportation of Wastes[1]			
Transportation of hazardous waste *on-site*	The generator manifesting requirements of 40 CFR 262.20262.32(b) do not apply. Generator or transporter must comply with the requirements set forth in 40 CFR 263.30 and 263.31 in the event of a discharge of hazardous waste on a private or public right-of-way.	Transportation of hazardous wastes on a public or private right-of-way within or along the border of contiguous property under the control of the same person, even if such contiguous property is divided by a public or private right-of-way – **applicable**	40 CFR 262.20(f) SCDHEC R. 61-79 262.20*(f)*
Transportation of hazardous waste *off-site*	Must comply with the generator requirements of 40 CFR 262.2023 for manifesting, Sect. 262.30 for packaging, Sect. 262.31 for labeling, Sect. 262.32 for marking, Sect. 262.33 for placarding, Sect. 262.40, 262.41(a) for record keeping requirements, and Sect. 262.12 to obtain EPA ID number.	Generator who initiates the off-site shipment of RCRA-hazardous waste – **applicable**	40 CFR 262.10(h) SCDHEC R. 61-79 262.10*(h)*

LIST OF ACTION-SPECIFIC ARARS/TBC
FOR SITE 3 AT MCRD, PARRIS ISLAND, SOUTH CAROLINA

Action	Requirements	Prerequisite	Citation
Transportation of hazardous materials	Shall be subject to and must comply with all applicable provisions of the HMTA and DOT HMR at 49 CFR 171-180.	Any person who, under contract with a department or agency of the federal government, transports "in commerce," or causes to be transported or shipped, a hazardous material – **applicable**	49 CFR 171.1(c)
Transportation of samples (i.e. solid waste, soils and wastewaters)	Are not subject to any requirements of 40 CFR Parts 261 through 268 or 270 when: • the sample is being transported to a laboratory for the purpose of testing; or • the sample is being transported back to the sample collector after testing. • the sample is being stored by sample collector before transport to a lab for testing.	Samples of solid waste or a sample of water, soil for purpose of conducting testing to determine its characteristics or composition – **applicable**	40 CFR 261.4(d)(1)(i)-(iii) SCDHEC R. 61-79 261.4*(d)* (1)
	In order to qualify for the exemption in 40 CFR 261.4 (d)(1)(i) and (ii), a sample collector shipping samples to a laboratory must: • Comply with U.S. DOT, U.S. Postal Service, or any other applicable shipping requirements. • Assure that the information provided in (1) thru (5) of this section accompanies the sample. • Package the sample so that it does not leak, spill, or vaporize from its packaging.		40 CFR 261.4(d)(2) 40 CFR 261.4(d)(2)(ii)(A) and (B) SCDHEC R. 61-79 261.4*(d)* (2)(ii)(A) and (B)

1 In the event that maintenance of the cover system results in the excavation (i.e., generation) of solid waste (including contaminated soils or sediments), then the RCRA regulations provided on the table apply and such waste must be characterized and managed accordingly.

ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
CWA = Clean Water Act of 1972
DEACT = deactivation
DOT = U.S. Department of Transportation
EPA = U.S. Environmental Protection Agency
HMR = Hazardous Materials Regulations
HMTA = Hazardous Materials Transportation Act
LDR = Land Disposal Restrictions
NPDES = National Pollutant Discharge Elimination System
RCRA = Resource Conservation and Recovery Act of 1976
SCDHEC = South Carolina Department of Health and Environmental Control
TBC = to be considered
TCLP = Toxicity Characteristic Leaching Procedure
UHC = underlying hazardous constituents
UTS = Universal Treatment Standard
WWTU = Waste Water Treatment Unit

LIST OF LOCATION-SPECIFIC ARARS/TBC
FOR SITE 3 AT MCRD PARRIS ISLAND, SOUTH CAROLINA

Location Characteristics	Requirements	Prerequisite	Citation
	Wetlands		
Presence of wetlands	Requires Federal agencies to evaluate action to minimize the destruction, loss or degradation of wetlands and to preserve and enhance beneficial values of wetlands.	Actions that involve potential impacts to, or take place within, wetlands – **TBC**	Executive Order 11990 – *Protection of Wetlands* Section 1.(a)
Floodplains			
Presence of 100-year floodplain	Must demonstrate that the unit will not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health and the environment.	Owners or operators of new MSWLF units, existing MSWLF units, and lateral expansions located in 100-year floodplains, as defined in R.61-107.19 Part I, Subpart B – **relevant and appropriate**	SCDHEC R.61-107.19 Part V Subpart B 258.11(a)
Presence of floodplain designated as such on a map	Shall consider alternatives to avoid, to the extent possible adverse effects and incompatible development in the floodplain.	Federal actions that involve potential impacts to, or take place within, floodplains –**TBC**	Executive Order 11988 – *Floodplain Management* Section 2.(a)(2)
	Aquatic Resources and Coastal Zone Areas		
Location encompassing navigable waters	Activities shall not block or obstruct navigation or the flow of any waters unless specifically authorized herein. No spoil, dredged material, or any other fill material shall be placed below the mean high water or ordinary high water elevation, unless specifically authorized herein. Shall make every reasonable effort to perform the authorized work in a manner to minimize adverse impact on fish, wildlife, or water quality.	Actions that involve any dredging, filling, or construction or alteration activity in, on, or over a navigable water, as defined in R. 19-450.2.C, or in, or on the bed under navigable waters, or in, or on lands or waters subject to a public navigational servitude under Article 14 Section 4 of the South Carolina Constitution and 49-1-10 of the 1976 S.C. Code of Laws including submerged lands under the navigable waters of the state, or for any activity significantly affecting the flow of any navigable water – **relevant and appropriate**	SCDHEC R. 19-450.4(7) SCDHEC R. 19-450.4(8)

LIST OF LOCATION-SPECIFIC ARARS/TBC
FOR SITE 3 AT MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 2 OF 5

Location Characteristics	Requirements	Prerequisite	Citation
Location encompassing *coastal waters* and *tidelands* (including coastal wetlands, mudflats, marshes and shallows) as defined in SCDHEC R. 30-10	Roadway embankments and fill areas shall be stabilized by utilizing appropriate erosion devices and/or techniques in order to minimize erosion and water quality degradation problems. Culverts shall be required, where appropriate, in order to maintain normal tidal influence and minimize disruption of drainage patterns.	Actions that involve dredging, filling, or construction activity in, on, over *critical areas* as defined in SCDHEC R. 30-10 (A) – **relevant and appropriate**	SCDHEC R. 30-12(F)(2)(h) Transportation Note: Jurisdictional Authority under South Carolina Coastal Tidelands and Wetlands Act (§§ 48-39-10 et seq)
	Dredging and filling in wetland areas should be undertaken only if that activity is water-dependent and there are no feasible alternatives. To the maximum extent feasible, dredging and filling activities should be restricted in nursery areas and shellfish grounds and during periods of migration, spawning, and early development of important sport and commercial species. Dredging and excavation shall not create stagnant water conditions, lethal fish entrapments, or deposit sumps or otherwise contribute to water quality degradation. Designs for dredging and excavation projects shall, where feasible, include protective measures such as silt curtains, diapers, and weirs to protect water quality in adjacent areas during construction by preventing the dispersal of silt materials. Dredged materials shall be deposited and contained in such a manner so as to prevent dispersal into adjacent wetland areas and, in all cases, new facilities must have permanent	Actions that involve dredging, filling, or construction activity in, on, over *critical areas* as defined in SCDHEC R. 30-10 (A) – **relevant and appropriate**	SCDHEC R. 30-12(G)(2)(b)-(f) Dredging and Filling Material

Location Characteristics	Requirements	Prerequisite	Citation
	upland disposal sites. Existing facilities must have either permanent upland disposal sites or EPA approved ocean disposal sites.		
Location encompassing *coastal waters* and *tidelands* (including coastal wetlands, mudflats, marshes and shallows) as defined in SCDHEC R. 30-10	The following standards are to be utilized: (a) Upland disposal of dredged material shall always be sought in preference to disposal in wetlands. Vegetated wetlands and mudflats shall not be utilized for disposal of dredged materials unless there are no feasible alternatives. Any other wetlands should not be utilized for disposal of dredged materials when other alternatives exist; (c) Dredged materials containing hazardous levels of toxic material must be disposed of with extraordinary caution. These materials shall never be disposed of in wetland areas and only in highland areas which are lined and diked with impervious materials.	Actions that involve dredging, filling, or construction activity in, on, over *critical areas* as defined in SCDHEC R. 30-10 (A) – **relevant and appropriate**	SCDHEC R. 30-12(I)(2)(a) and (c) Deposition of Dredged Material
Location encompassing *aquatic ecosystem* as defined in 40 CFR 230.3(c)	No discharge of dredged or fill material into an aquatic ecosystem is permitted if there is a practicable alternative that would have less adverse impact. No discharge of dredged or fill material shall be permitted unless appropriate and practicable steps in accordance with 40 CFR 230.70 *et seq.* have been taken that will minimize potential adverse impacts of the discharge on the aquatic ecosystem.	Action that involves the discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands – **applicable**	40 CFR 230.10(a) 40 CFR 230.10(d)

LIST OF LOCATION-SPECIFIC ARARS/TBC
FOR SITE 3 AT MCRD PARRIS ISLAND, SOUTH CAROLINA

Location Characteristics	Requirements	Prerequisite	Citation
	Must comply with the substantive requirements of the NWP 38 General Conditions, as appropriate, any regional or case-specific conditions recommended by the Corps District Engineer, after consultation. *Note:* Despite that consultation may be considered an administrative requirement, it should be performed to ensure activities are in compliance with substantive provisions of the permit.	On-site CERCLA action conducted by Federal agency that involves the discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands – **relevant and appropriate**	Nation Wide Permit (38) Cleanup of Hazardous and Toxic Waste 33 CFR 323.3(b)
Threatened and Endangered Species			
Presence of Threatened and Endangered Wildlife listed in 50 CFR 17.11(h) – or critical habitat of such species	Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary of Interior, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section. *Note:* Despite that consultation may be considered an administrative requirement, it should be performed to ensure activities are in compliance with substantive provisions of the Endangered Species Act and regulations.	Agency action that may jeopardize listed wildlife species, or destroy or adversely modify critical habitat – **applicable**	16 U.S.C. 1536 (a)(2) –or Section 7(a)(2) of *the Endangered Species Act of 1973*

LIST OF LOCATION-SPECIFIC ARARS/TBC
FOR SITE 3 AT MCRD PARRIS ISLAND, SOUTH CAROLINA

Location Characteristics	Requirements	Prerequisite	Citation
Presence of Threatened and Endangered Wildlife listed in 50 CFR 17.11(h)	It is unlawful to take threatened or endangered wildlife in the United States. No person may take any American Alligator except as provided in 50 CFR 17.42(a)(2)(i) and (ii). *Note:* Under 50 CFR 10.12 *Definitions* the term *Take* means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect.	Action that may jeopardize listed wildlife species – **applicable**	50 CFR 17.21(c) 50 CFR 17.31(a) 50 CFR 17.42(a)(2)

ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
EPA = U.S. Environmental Protection Agency
SCDHEC = South Carolina Department of Health and Environmental Control
TBC = to be considered

Appendix B
Cost Estimate

Site/SWMU 3 - Causeway Landfill
Marine Corps Recruit Depot
Parris Island, South Carlolina
Modified 3A - Partial Soil Cover / Slope Stabilization / With Further Sediment Evaluation for Proposed Plan
Annual Cost

Item	Item Cost Annually	Item Cost per 5 Years	Notes
Site Maintenance			
landscaping / grass cutting	$12,000.00		based on 2 cuts per month for 12 months mob/demob, equipment (truck, mowers, etc.), misc. materials and hand tools
rip rap	$8,000.00		annual rip rap repair/replacement (100 cy/yr at $38.00 per year)
gabions	$10,000.00		annual gabion basket replacement (100 /yr at $100 ea.)
top soil	$7,000.00		annual top soil replacement (400 lcy/yr at $17.00/lcy)
vegetation	$4,000.00		annual vegetation replacement (50 msf at $75/msf)
wetlands vegetation	(1) ***see note below***		wetland vegetation cost of about $15,000/acre and assume more replacement early, tapering off to none after year five - see note below
Sampling	$3,150.00		(2) 4 GW and 3 sediment samples at about $450 per sample including dups, travel, living, and per diem
Analysis	$4,550.00		(2) 7 samples at about $650 per sample including dups, blanks, shipping, etc.
Annual Report	$10,000.00		Yearly Site Inspection Report (not inclusive of sampling and analysis costs)
Site Review		$16,000.00	Prepare Site Conditions Report for years 5, 10, 15, 20, 25, and 30
TOTALS	$58,700.00	$16,000.00	

(1) * Wetlands Vegetation costs by year**

Year	Area (acres)	Cost	
1	0.675	$10,000	assumes approximately 15% of total will need replaced after year one
2	0.450	$7,000	assumes approximately 10% of total will need replaced after year two
3	0.250	$4,000	assumes approximately 5% of total will need replaced after year three
4	0.000	$0	assumes approximately 0% of total will need replaced after year four
5	0.000	$0	assumes 0% of total will need replaced from year 5 out

(2) **Sampling and Analysis occurs every year for the first 5 years.

Site/SWMU 3 - Causeway Landfill
Marine Corps Recruit Depot
Parris Island, South Carlolina
Modified 3A - Partial Soil Cover / Slope Stabilization / With Further Sediment Evaluation for Proposed Pl.
Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	$4,721,696		$4,721,696.24	1.000	$4,721,696
1		$68,700.00	$68,700.00	0.935	$64,235
2		$65,700.00	$65,700.00	0.873	$57,356
3		$62,700.00	$62,700.00	0.816	$51,163
4		$58,700.00	$58,700.00	0.763	$44,788
5		$74,700.00	$74,700.00	0.713	$53,261
6		$58,700.00	$58,700.00	0.666	$39,094
7		$58,700.00	$58,700.00	0.623	$36,570
8		$58,700.00	$58,700.00	0.582	$34,163
9		$58,700.00	$58,700.00	0.544	$31,933
10		$74,700.00	$74,700.00	0.508	$37,948
11		$58,700.00	$58,700.00	0.475	$27,883
12		$58,700.00	$58,700.00	0.444	$26,063
13		$58,700.00	$58,700.00	0.415	$24,361
14		$58,700.00	$58,700.00	0.388	$22,776
15		$74,700.00	$74,700.00	0.362	$27,041
16		$58,700.00	$58,700.00	0.339	$19,899
17		$58,700.00	$58,700.00	0.317	$18,608
18		$58,700.00	$58,700.00	0.296	$17,375
19		$58,700.00	$58,700.00	0.277	$16,260
20		$74,700.00	$74,700.00	0.258	$19,273
21		$58,700.00	$58,700.00	0.242	$14,205
22		$58,700.00	$58,700.00	0.226	$13,266
23		$58,700.00	$58,700.00	0.211	$12,386
24		$58,700.00	$58,700.00	0.197	$11,564
25		$74,700.00	$74,700.00	0.184	$13,745
26		$58,700.00	$58,700.00	0.172	$10,096
27		$58,700.00	$58,700.00	0.161	$9,451
28		$58,700.00	$58,700.00	0.150	$8,805
29		$58,700.00	$58,700.00	0.141	$8,277
30		$74,700.00	$74,700.00	0.131	$9,786
				TOTAL PRESENT WORTH	**$5,503,326**

Appendix C
Human Health Risk Tables

Appendix C.1
RI HHRA Supporting Tables

TABLE 3.1

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Site 3

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Benzo(a)pyrene equivalents	mg/kg	0.361	0.934	4.92		mg/kg	4.92	Max	W - Test (2)	N/A	N/A	N/A
Aluminum	mg/kg	5745	6722	10800		mg/kg	7137	95% UCL-L	W - Test (1)	N/A	N/A	N/A
Arsenic	mg/kg	1.67	2.87	11.8		mg/kg	11.8	Max	W - Test (2)	N/A	N/A	N/A
Iron	mg/kg	4788	5577	7370		mg/kg	5916	95% UCL-L	W - Test (1)	N/A	N/A	N/A

Notes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) - Shapiro-Wilk W Test indicates that data is lognormally distributed.

(2) - Shapiro-Wilk W Test was inconclusive.

TABLE 3.2

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site 3

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Benzene	ug/L	5.58	(1)	21		ug/L	21	Max	(1)	N/A	N/A	N/A
Chlorobenzene	ug/L	32.9	(1)	130		ug/L	130	Max	(1)	N/A	N/A	N/A
Chloroform	ug/L	0.45	(1)	0.3		ug/L	0.3	Max	(1)	N/A	N/A	N/A
1,4-Dichlorobenzene	ug/L	4.38	(1)	10		ug/L	10	Max	(1)	N/A	N/A	N/A
4-Methylphenol	ug/L	20.1	(1)	73		ug/L	18	Max	(1)	N/A	N/A	N/A
alpha-BHC	ug/L	0.049	(1)	0.12		ug/L	0.12	Max	(1)	N/A	N/A	N/A
Arsenic	ug/L	10.6	(1)	34.5		ug/L	34.5	Max	(1)	N/A	N/A	N/A
Barium	ug/L	357	(1)	854		ug/L	854	Max	(1)	N/A	N/A	N/A
Iron	ug/L	23633	(1)	32600		ug/L	32600	Max	(1)	N/A	N/A	N/A
Manganese	ug/L	391	(1)	708		ug/L	708	Max	(1)	N/A	N/A	N/A
Thallium	ug/L	2.23	(1)	2.6		ug/L	2.6	Max	(1)	N/A	N/A	N/A

Notes:

(1) - Not enough samples to calculate an UCL or to perform the Shapiro-Wilk W Test.

TABLE 3.3

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Site 3

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Benzo(a)pyrene equivalents	mg/kg	0.113	0.287	1.49		mg/kg	1.49	Max	W - Test (1)	N/A	N/A	N/A
Aluminum	mg/kg	13060	16715	29700		mg/kg	29700	Max	W - Test (1)	N/A	N/A	N/A
Arsenic	mg/kg	6.44	8.45	19.8		mg/kg	8.45	95% UCL-N	W - Test (2)	N/A	N/A	N/A
Iron	mg/kg	12745	15948	28000		mg/kg	15948	95% UCL-N	W - Test (2)	N/A	N/A	N/A
Vanadium	mg/kg	29.1	36.9	63.7		mg/kg	63.7	Max	W - Test (1)	N/A	N/A	N/A

Notes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) - Shapiro-Wilk W Test was Inconclusive.

(2) - Shapiro-Wilk W Test indicates that data is lognormally distributed.

TABLE 3.4

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Site 3

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Benzo(a)pyrene equivalents	ug/L	0.492	Undefined	0.896		ug/L	0.896	Max	W - Test (1)	N/A	N/A	N/A
Bis(2-ethylhexyl)phthalate	ug/L	4.85	5.2712	7	J	ug/L	7	Max	W - Test (1)	N/A	N/A	N/A
Aluminum	ug/L	5360	12940	88600		ug/L	88600	Max	W - Test (1)	N/A	N/A	N/A
Arsenic	ug/L	5.7625	13.93	96.1		ug/L	96.1	Max	W - Test (1)	N/A	N/A	N/A
Copper	ug/L	9.63	22.6	152		ug/L	152	Max	W - Test (1)	N/A	N/A	N/A
Manganese	ug/L	727250	776854	840		ug/L	840	Max	W - Test (1)	N/A	N/A	N/A
Iron	ug/L	24459	15563	110000		ug/L	100000	Max	W - Test (1)	N/A	N/A	N/A

Notes:

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) - Shapiro-Wilk W Test was inconclusive.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3) (MM/DD/YY)
VOCs										
Benzene	Chronic	3.0E-03	mg/kg/day	97%	2.9E-03	mg/kg/day	Blood		EPAIII	11/01/99
Chlorobenzene	Chronic	2.0E-02	mg/kg/day	31%	6.2E-03	mg/kg/day	Liver	1000	IRIS	11/01/99
Chloroform	Chronic	1.0E-02	mg/kg/day	20%	2.0E-03	mg/kg/day	Liver	1000	IRIS	11/01/99
SVOCs										
1,4-Dichlorobenzene	Chronic	3.0E-02	mg/kg/day	90%	2.7E-02	mg/kg/day	Liver	30	EPAIII	11/01/99
4-Methylphenol	Chronic	5.0E-03	mg/kg/day	65%	3.3E-03	mg/kg/day	CNS	1000	HEAST	07/97
Benzo(a)anthracene	N/A	N/A	mg/kg/day	31%	N/A	mg/kg/day	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	N/A	N/A	mg/kg/day	31%	N/A	mg/kg/day	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	N/A	N/A	mg/kg/day	31%	N/A	mg/kg/day	N/A	N/A	N/A	N/A
Benzo(a)pyrene	N/A	N/A	mg/kg/day	31%	N/A	mg/kg/day	N/A	N/A	N/A	N/A
Bis(2-ethylhexyl)phthalate	Chronic	2.0E-02	mg/kg/day	19%	3.8E-03	mg/kg/day	Liver	1000	IRIS	11/01/99
Carbazole	N/A	N/A	mg/kg/day	31%	N/A	mg/kg/day	N/A	N/A	N/A	N/A
Chrysene	N/A	N/A	mg/kg/day	31%	N/A	mg/kg/day	N/A	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	N/A	N/A	mg/kg/day	31%	N/A	mg/kg/day	N/A	N/A	N/A	N/A
Pesticides/PCBs										
alpha-BHC	N/A	N/A	mg/kg/day	97%	N/A	mg/kg/day	N/A	N/A	N/A	N/A
4,4'-DDD	N/A	N/A	mg/kg/day	70%	N/A	mg/kg/day	N/A	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	mg/kg/day	70%	N/A	mg/kg/day	N/A	N/A	N/A	N/A
4,4'-DDT	Chronic	5.00E-04	mg/kg/day	70%	3.5E-04	mg/kg/day	N/A	N/A	N/A	N/A
alpha-chlordane	N/A	N/A	mg/kg/day	50%	N/A	mg/kg/day	N/A	N/A	N/A	N/A
gamma-chlordane	N/A	N/A	mg/kg/day	50%	N/A	mg/kg/day	N/A	N/A	N/A	N/A
Aroclor-1254	Chronic	2E-05	mg/kg/day	90%	1.8E-05	mg/kg/day	Immune, CNS	300	IRIS	11/01/99
Aroclor-1260	N/A	N/A	mg/kg/day	90%	N/A	mg/kg/day	N/A	N/A	N/A	N/A
Dieldrin	Chronic	5E-05	mg/kg/day	50%	2.5E-05	mg/kg/day	Liver	100	IRIS	11/01/99
Inorganics										
Aluminum	Chronic	1.0E+00	mg/kg/day	10%	1.0E-01	mg/kg/day	CNS	N/A	EPAIII	N/A
Arsenic	Chronic	3.0E-04	mg/kg/day	41%	1.2E-04	mg/kg/day	Skin	3	IRIS	11/01/99
Barium	Chronic	7.0E-02	mg/kg/day	7%	4.9E-03	mg/kg/day	CVS	3	IRIS	11/01/99
Copper	Chronic	4.0E-02	mg/kg/day	30%	1.2E-02	mg/kg/day	GI Tract	N/A	HEAST	07/97
Iron	Chronic	3.0E-01	mg/kg/day	15%	4.5E-02	mg/kg/day	Liver	N/A	EPAIII	N/A

TABLE 5.1

NON-CANCER TOXICITY DATA – ORAL/DERMAL

MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3) (MM/DD/YY)
Manganese	Chronic	2.0E-02	mg/kg/day	4%	8.0E-04	mg/kg/day	CNS	1	IRIS	11/01/99
Mercury	Chronic	3.0E-04	mg/kg/day	0.01%	3.0E-08	mg/kg/day	CNS	1000	IRIS	11/01/99
Thallium	Chronic	7.0E-05	mg/kg/day	15%	1.1E-05	mg/kg/day	Liver, Blood	N/A	EPAIII	N/A
Vanadium	Chronic	7.0E-03	mg/kg/day	1.0%	7.0E-05	mg/kg/day	None reported	100	HEAST	07/97

Notes;

(1) - USEPA Region IV, February 26, 1996.

(2) - RfDdermal = RfDoral x Oral to Dermal Adjustment Factor

(3) For IRIS values date that IRIS was searched.

For HEAST values, provide the date of HEAST.

FOR EPAIII, date of RBC Table.

N/A = Not Applicable

TABLE 6.1

CANCER TOXICITY DATA – ORAL/DERMAL

MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal Cancer Slope Factor (2)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (3) (MM/DD/YY)
VOCs							
Benzene	2.9E-02	97%	3.0E-02	$(mg/kg/day)^{-1}$	A	IRIS	11/01/99
Chlorobenzene	N/A	31%	N/A	$(mg/kg/day)^{-1}$	D	N/A	11/01/99
Chloroform	6.1E-03	20%	3.1E-02	$(mg/kg/day)^{-1}$	B2	IRIS	11/01/99
SVOCs							
1,4-Dichlorobenzene	2.4E-02	90%	2.7E-02	$(mg/kg/day)^{-1}$	C	HEAST	07/97
4-Methylphenol	N/A	65%	N/A	$(mg/kg/day)^{-1}$	C	N/A	N/A
Benzo(a)anthracene	N/A	31%	N/A	$(mg/kg/day)^{-1}$	B2	N/A	N/A
Benzo(b)fluoranthene	N/A	31%	N/A	$(mg/kg/day)^{-1}$	B2	N/A	N/A
Benzo(k)fluoranthene	N/A	31%	N/A	$(mg/kg/day)^{-1}$	B2	N/A	N/A
Benzo(a)pyrene	7.3E+00	31%	2.4E+01	$(mg/kg/day)^{-1}$	B2	IRIS	11/01/99
Bis(2-ethylhexyl)phthalate	1.4E-02	19%	7.4E-02	$(mg/kg/day)^{-1}$	B2	IRIS	11/01/99
Carbazole	2.0E-02	31%	6.5E-02	$(mg/kg/day)^{-1}$		HEAST	07/97
Chrysene	N/A	31%	N/A	$(mg/kg/day)^{-1}$	B2	N/A	N/A
Indeno(1,2,3-cd)pyrene	N/A	31%	N/A	$(mg/kg/day)^{-1}$	B2	N/A	N/A
Pesticides/PCBs							
alpha-BHC	6.3E+00	97%	6.5E+00	$(mg/kg/day)^{-1}$	B2	IRIS	11/01/99
4,4'-DDD	2.4E-01	70%	3.4E-01	$(mg/kg/day)^{-1}$	B2	IRIS	11/01/99
4,4'-DDE	3.4E-01	70%	4.9E-01	$(mg/kg/day)^{-1}$	B2	IRIS	11/01/99
4,4'-DDT	3.4E-01	70%	4.9E-01	$(mg/kg/day)^{-1}$	B2	IRIS	11/01/99
alpha-chlordane	3.5E-01	50%	7.0E-01	$(mg/kg/day)^{-1}$	B2	IRIS	11/01/99
gamma-chlordane	3.5E-01	50%	7.0E-01	$(mg/kg/day)^{-1}$	B2	IRIS	11/01/99
Aroclor-1254	2.0E+00	90%	2.2E+00	$(mg/kg/day)^{-1}$	B2	IRIS	11/01/99
Aroclor-1260	2.0E+00	90%	2.2E+00	$(mg/kg/day)^{-1}$	B2	IRIS	11/01/99
Dieldrin	1.6E+01	50%	3.2E+01	$(mg/kg/day)^{-1}$	B2	IRIS	11/01/99

TABLE 6.1

CANCER TOXICITY DATA – ORAL/DERMAL

MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal Cancer Slope Factor (2)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (3) (MM/DD/YY)
Inorganics							
Aluminum	N/A	10%	N/A	$(mg/kg/day)^{-1}$	N/A	N/A	N/A
Arsenic	1.5E+00	41%	3.7E+00	$(mg/kg/day)^{-1}$	A	IRIS	11/01/99
Barium	N/A	7%	N/A	$(mg/kg/day)^{-1}$	D	N/A	N/A
Copper	N/A	30%	N/A	$(mg/kg/day)^{-1}$	N/A	N/A	N/A
Iron	N/A	15%	N/A	$(mg/kg/day)^{-1}$	N/A	N/A	N/A
Manganese	N/A	4%	N/A	$(mg/kg/day)^{-1}$	D	N/A	N/A
Mercury	N/A	1%	N/A	$(mg/kg/day)^{-1}$	C	IRIS	11/01/99
Thallium	N/A	15%	N/A	$(mg/kg/day)^{-1}$	N/A	N/A	N/A
Vanadium	N/A	1%	N/A	$(mg/kg/day)^{-1}$	N/A	N/A	N/A

Notes:

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

(1) - USEPA Region IV, February 26, 1996.

(2) - CSFdermal = CSForal/Oral to Dermal Adjustment Factor.

(3) - For IRIS values, provide the date IRIS was searched.
For HEAST values, provide the date of HEAST.

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

TABLE 9.1
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current/Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site/SWMU 3 - Causeway Landfill	Benzo(a)pyrene equivalents	1.2E-06	--	4.3E-06	5.5E-06	Benzo(a)pyrene equivalents	N/A	--	--	--	--
			Aluminum	--	--	--	--	Aluminum	CNS	1.7E-02	--	1.4E-03	1.8E-02
			Arsenic	5.9E-07	--	3.7E-07	9.6E-07	Arsenic	Skin	9.2E-02	--	5.8E-02	1.5E-01
			Iron	--	--	--	--	Iron	Liver	4.6E-02	--	2.6E-03	4.9E-02
			(Total)	1.8E-06	--	4.7E-06	6.5E-06	(Total)		1.6E-01	--	6.2E-02	2.2E-01
Groundwater	Groundwater	Site/SWMU 3 - Causeway Landfill	Benzene	--	--	3.2E-09	3.2E-09	Benzene	Blood	--	--	2.6E-03	2.6E-03
			Chlorobenzene	--	--	--	--	Chlorobenz	Liver	--	--	1.5E-02	1.5E-02
			Chloroform	--	--	2.1E-11	2.1E-11	Chloroform	Liver	--	--	2.4E-05	2.4E-05
			1,4-Dichlorobenzene	--	--	4.0E-16	4.0E-16	1,4-Dichlorobenzene	Liver	--	--	3.9E-11	3.9E-11
			4-Methylphenol	--	--	--	--	4-Methylphenol	CNS	--	--	9.9E-04	9.9E-04
			alpha-BHC	--	--	7.6E-09	7.6E-09	alpha-BHC	N/A	--	--	--	--
			Arsenic	--	--	3.0E-08	3.0E-08	Arsenic	Skin	--	--	4.6E-03	4.6E-03
			Barium	--	--	--	--	Barium	CVS	--	--	2.9E-03	2.9E-03
			Iron	--	--	--	--	Iron	Liver	--	--	1.2E-02	1.2E-02
			Manganese	--	--	--	--	Manganese	CNS	--	--	1.4E-02	1.4E-02
			Thallium	--	--	--	--	Thallium	Liver, Blood	--	--	4.1E-03	4.1E-03
			(Total)	--	--	4.0E-08	4.0E-08	(Total)		--	--	5.6E-02	5.6E-02
Sediment	Sediment	Site/SWMU 3 - Causeway Landfill	Benzo(a)pyrene equivalents	6.1E-08	--	2.2E-07	2.8E-07	Benzo(a)pyrene equivalents	N/A	--	--	--	--
			Aluminum	--	--	--	--	Aluminum	CNS	1.2E-02	--	1.0E-03	1.3E-02
			Arsenic	7.1E-08	--	4.5E-08	1.2E-07	Arsenic	Skin	1.1E-02	--	6.9E-03	1.8E-02
			Iron	--	--	--	--	Iron	Liver	2.1E-02	--	1.2E-03	2.2E-02
			Vanadium	--	--	--	--	Vanadium	None reported	3.6E-03	--	3.1E-03	6.7E-03
			(Total)	1.3E-07	--	2.6E-07	4.0E-07	(Total)		4.7E-02	--	1.2E-02	6.0E-02
Surface Water	Surface Water	Site/SWMU 3 - Causeway Landfill	Benzo(a)pyrene equivalents	6.1E-09	--	9.9E-06	9.9E-06	Benzo(a)pyrene equivalents	N/A	--	--	--	--
			Bis(2-ethylhexyl)phthalate	9.2E-11	--	1.8E-08	1.8E-08	Bis(2-ethylhexyl)phthalate	Liver	2.3E-05	--	4.5E-03	4.5E-03
			Aluminum	--	--	--	--	Aluminum	CNS	5.8E-03	--	1.5E-02	2.0E-02
			Arsenic	1.4E-07	--	6.2E-08	2.2E-07	Arsenic	Skin	2.1E-02	--	1.3E-02	3.4E-02
			Iron	--	--	--	--	Iron	Liver	2.2E-02	--	3.6E-02	5.8E-02
			Manganese	--	--	--	--	Manganese	CNS	2.8E-03	--	1.7E-02	2.0E-02
			(Total)	1.4E-07	--	1.0E-05	1.0E-05	(Total)		5.2E-02	--	6.5E-02	1.4E-01
							Total Risk Across[Soil]	6.5E-06					Total Hazard Index Across All Media and All Exposure Routes	4.7E-01
							Total Risk Across[Groundwater]	4.0E-08					
							Total Risk Across[Sediment]	4.0E-07					
							Total Risk Across[Surface Water]	1.0E-05					
							Total Risk Across All Media and All Exposure Routes	1.7E-05					

TABLE 9.2

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current/Future
Receptor Population: Maintenance Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site/SWMU 3 - Causeway Landfill	Benzo(a)pyrene equivalents	2.5E-06	--	4.3E-05	4.6E-05	Benzo(a)pyrene equivalents	N/A	--	--	--	--
			Aluminum	--	--	--	--	Aluminum	CNS	1.4E-03	--	5.7E-04	2.0E-03
			Arsenic	1.2E-06	--	3.7E-06	4.9E-06	Arsenic	Skin	7.7E-03	--	2.3E-02	3.1E-02
			Iron	--	--	--	--	Iron	Liver	3.9E-03	--	1.1E-03	4.9E-03
			(Total)	3.7E-06	--	4.7E-05	5.1E-05	(Total)		1.3E-02	--	2.5E-02	3.8E-02
Sediment	Sediment	Site/SWMU 3 - Causeway Landfill	Benzo(a)pyrene equivalents	3.8E-07	--	6.5E-06	6.9E-06	Benzo(a)pyrene equivalents	N/A	--	--	--	--
			Aluminum	--	--	--	--	Aluminum	CNS	2.9E-03	--	1.2E-03	4.1E-03
			Arsenic	4.4E-07	--	1.3E-06	1.8E-06	Arsenic	Skin	2.8E-03	--	8.3E-03	1.1E-02
			Iron	--	--	--	--	Iron	Liver	5.2E-03	--	1.4E-03	6.6E-03
			Vanadium	--	--	--	--	Vanadium	None reported	8.9E-04	--	3.7E-03	4.5E-03
			(Total)	8.2E-07	--	7.9E-06	8.7E-06	(Total)		1.2E-02	--	1.5E-02	2.6E-02
							Total Risk Across[Soil]	5.1E-05					Total Hazard Index Across All Media and All Exposure Routes	6.4E-02
							Total Risk Across[Sediment]	8.7E-06					
							Total Risk Across All Media and All Exposure Routes	5.9E-05					

TABLE 9.3
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current/Future
Receptor Population: Adult Recreational Users
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Finfish/Shellfish	Site/SWMU 3 - Causeway Landfill	Dieldrin	5.0E-06	--	--	5.0E-06	Dieldrin	Liver	1.4E-02	--	--	1.4E-02
			DDE	4.9E-06	--	--	4.9E-06	DDE	N/A	--	--	--	--
			Heptachlor Epoxide	2.7E-06	--	--	2.7E-06	Heptachlor Epoxide	Liver	2.4E-01	--	--	2.4E-01
			Mercury	--	--	--	--	Mercury	CNS	1.6E-01	--	--	1.6E-01
			Aroclor 1254	3.7E-05	--	--	3.7E-05	Aroclor 1254	Immune, CNS	2.2E+00	--	--	2.2E+
			(Total)	5.0E-05	--	--	5.0E-05	(Total)		2.6E+00	--	--	2.6E+00
Surface Water/ Sediment	Surface Water/ Sediment	Site/SWMU 3 - Causeway Landfill Maximum Concentration	Benzo(a)pyrene equivalents	7.1E-04	--	--	7.1E-04	Benzo(a)pyrene equivalents	N/A	--	--	--	0.00
			Carbazole	2.6E-06	--	--	2.6E-06	Carbazole	N/A	--	--	--	0.00
			4,4'-DDD	4.4E-06	--	--	4.4E-06	4,4'-DDD	N/A	--	--	--	0.00
			4,4'-DDE	2.7E-05	--	--	2.7E-05	4,4'-DDE	N/A	--	--	--	0.00
			4,4'-DDT	4.4E-06	--	--	4.4E-06	4,4'-DDT	N/A	6.0E-02	--	--	0.06
			alpha-chlordane	1.1E-05	--	--	1.1E-05	alpha-chlordane	N/A	--	--	--	0.00
			gamma-chlordane	4.9E-06	--	--	4.9E-06	gamma-chlordane	N/A	--	--	--	0.00
			Aroclor-1254	2.1E-04	--	--	2.1E-04	Aroclor-1254	Immune, CNS	1.2E+01	--	--	12.22
			Aroclor-1260	5.9E-05	--	--	5.9E-05	Aroclor-1260	N/A	--	--	--	0.00
			Arsenic	7.8E-04	--	--	7.8E-04	Arsenic	Skin	4.0E+00	--	--	4.03
			Copper	--	--	--	--	Copper	GI Tract	1.0E-01	--	--	0.10
			Mercury	--	--	--	--	Mercury	CNS	1.4E+00	--	--	1.39
			(Total)	1.8E-03			1.8E-03	(Total)		1.8E+01	--	--	17.80
Surface Water/ Sediment	Surface Water/ Sediment	Site/SWMU 3 - Causeway Landfill Average Concentration	Benzo(a)pyrene equivalents	1.6E-05	--	--	1.6E-05	Benzo(a)pyrene equivalents	N/A	--	--	--	--
			Carbazole	1.9E-06	--	--	1.9E-06	Carbazole	N/A	--	--	--	--
			4,4'-DDD	6.3E-07	--	--	6.3E-07	4,4'-DDD	N/A	--	--	--	--
			4,4'-DDE	1.7E-05	--	--	1.7E-05	4,4'-DDE	N/A	--	--	--	--
			4,4'-DDT	3.7E-06	--	--	3.7E-06	4,4'-DDT	N/A	5.1E-02	--	--	5.1E-02
			alpha-chlordane	5.5E-05	--	--	5.5E-05	alpha-chlordane	N/A	--	--	--	--
			gamma-chlordane	2.6E-05	--	--	2.6E-05	gamma-chlordane	N/A	--	--	--	--
			Aroclor-1254	2.4E-05	--	--	2.4E-05	Aroclor-1254	Immune, CNS	1.4E+00	--	--	1.4E+00
			Aroclor-1260	1.2E-05	--	--	1.2E-05	Aroclor-1260	N/A	--	--	--	--
			Arsenic	4.7E-05	--	--	4.7E-05	Arsenic	Skin	2.4E-01	--	--	2.4E-01
			Copper	--	--	--	--	Copper	GI Tract	6.4E-03	--	--	6.4E-03
			Mercury	--	--	--	--	Mercury	CNS	5.1E-01	--	--	5.1E-01
			(Total)	2.0E-04			2.0E-04	(Total)		2.2E+00	--	--	2.2E+00

TABLE 9.4

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

SITE-SPECIFIC EXPOSURES

MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current/Future
Receptor Population: Adult Recreational Users
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Finfish/Shellfish	Site/SWMU 3 - Causeway Landfill	Dieldrin	3.4E-07	--	--	3.4E-07	Dieldrin	Liver	5.0E-03	--	--	5.0E-03
			DDE	3.3E-07	--	--	3.3E-07	DDE	N/A	--	--	--	--
			Heptachlor Epoxide	1.9E-07	--	--	1.9E-07	Heptachlor Epoxide	Liver	1.9E-02	--	--	1.9E-02
			Mercury	--	--	--	--	Mercury	CNS	5.6E-02	--	--	5.6E-02
			Aroclor 1254	2.6E-06	--	--	2.6E-06	Aroclor 1254	Immune, CNS	7.5E-01	--	--	7.5E-01
			(Total)	3.5E-06	--	--	3.5E-06	(Total)		8.3E-01	--	--	8.3E-01
Surface Water/ Sediment	Surface Water/ Sediment	Site/SWMU 3 - Causeway Landfill Maximum Concentration	Benzo(a)pyrene equivalents	4.9E-05	--	--	4.9E-05	Benzo(a)pyrene equivalents	N/A	--	--	--	--
			Carbazole	1.8E-07	--	--	1.8E-07	Carbazole	N/A	--	--	--	--
			4,4'-DDD	3.0E-07	--	--	3.0E-07	4,4'-DDD	N/A	--	--	--	--
			4,4'-DDE	1.8E-06	--	--	1.8E-06	4,4'-DDE	N/A	--	--	--	--
			4,4'-DDT	3.0E-07	--	--	3.0E-07	4,4'-DDT	N/A	2.1E-02	--	--	0.02
			alpha-chlordane	7.3E-07	--	--	7.3E-07	alpha-chlordane	N/A	--	--	--	0.00
			gamma-chlordane	3.4E-07	--	--	3.4E-07	gamma-chlordane	N/A	--	--	--	0.00
			Aroclor-1254	1.4E-05	--	--	1.4E-05	Aroclor-1254	Immune, CNS	4.2E+00	--	--	4.22
			Aroclor-1260	4.0E-06	--	--	4.0E-06	Aroclor-1260	N/A	--	--	--	0.00
			Arsenic	5.4E-05	--	--	5.4E-05	Arsenic	Skin	1.4E+00	--	--	1.39
			Copper	--	--	--	--	Copper	GI Tract	3.5E-02	--	--	0.03
			Mercury	--	--	--	--	Mercury	CNS	4.8E-01	--	--	0.48
			(Total)	1.3E-04			1.3E-04	(Total)		6.1E+00	--	--	6.15
Surface Water/ Sediment	Surface Water/ Sediment	Site/SWMU 3 - Causeway Landfill Average Concentration	Benzo(a)pyrene equivalents	1.1E-06	--	--	1.1E-06	Benzo(a)pyrene equivalents	N/A	--	--	--	--
			Carbazole	1.3E-07	--	--	1.3E-07	Carbazole	N/A	--	--	--	--
			4,4'-DDD	4.3E-08	--	--	4.3E-08	4,4'-DDD	N/A	--	--	--	--
			4,4'-DDE	1.2E-06	--	--	1.2E-06	4,4'-DDE	N/A	--	--	--	--
			4,4'-DDT	2.6E-07	--	--	2.6E-07	4,4'-DDT	N/A	1.8E-02	--	--	1.8E-02
			alpha-chlordane	3.8E-06	--	--	3.8E-06	alpha-chlordane	N/A	--	--	--	--
			gamma-chlordane	1.8E-06	--	--	1.8E-06	gamma-chlordane	N/A	--	--	--	--
			Aroclor-1254	1.6E-06	--	--	1.6E-06	Aroclor-1254	Immune, CNS	4.8E-01	--	--	4.8E-01
			Aroclor-1260	8.5E-07	--	--	8.5E-07	Aroclor-1260	N/A	--	--	--	--
			Arsenic	3.2E-06	--	--	3.2E-06	Arsenic	Skin	8.3E-02	--	--	8.3E-02
			Copper	--	--	--	--	Copper	GI Tract	2.2E-03	--	--	2.2E-03
			Mercury	--	--	--	--	Mercury	CNS	1.8E-01	--	--	1.8E-01
			(Total)	1.4E-05			1.4E-05	(Total)		7.6E-01	--	--	7.6E-01

Appendix C.2
Post-Interim Remedy HHRA Supporting Tables

TABLE 3.1.RME
EXPOSURE POINT CONCENTRATION SUMMARY
SITE 3 - CAUSEWAY LANDFILL - POND
MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Pond	Mercury	mg/kg	0.143	0.143 (G)	0.564	0.143	mg/kg	95% KM(T)	PRO UCL 4.0.04
	TEQ PCB	mg/kg	0.000007	0.0000026 (G)	6.97 E-6	0.0000026	mg/kg	95% APPROXIMATE GAMMA	PRO UCL 4.0.04
	4,4'-DDD	mg/kg	0.003	0.0059 (G)	0.014 J	0.0059	mg/kg	95% KM(T)	PRO UCL 4.0.04
	4,4'-DDE	mg/kg	0.018	0.029 (G)	0.071 J	0.029	mg/kg	95% APPROXIMATE GAMMA	PRO UCL 4.0.04
	4,4'-DDT	mg/kg	0.003	0.0037 (G)	0.0072 J	0.0037	mg/kg	95% KM(PERCENTILE BOOTSTRAP)	PRO UCL 4.0.04

For non-detects, one half the sample quantitation limit was used as a proxy concentration.
G - Gamma distribution.
N - Normal distribution.
NP - Non-parmetric distribution.
J - Estimated value.

TABLE 5.1
NON-CANCER TOXICITY DATA – ORAL/DERMAL
SITE 3 - CAUSEWAY LANDFILL - POND
MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal[1]	Absorbed RfD for Dermal[2]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Pesticides										
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dioxin-Like PCBs										
2,3,7,8-TCDD (dioxin-like PCBs)	Chronic	1.0E-09	mg/kg/day	1	1.0E-09	mg/kg/day	NA	NA	ATSDR	12/2009
Inorganics										
Copper	Chronic	4.0E-02	mg/kg/day	1	4.0E-02	mg/kg/day	GS	NA	HEAST	7/1997
Mercury[3]	Chronic	1.0E-04	mg/kg/day	1	1.0E-04	mg/kg/day	CNS	10/1	IRIS	5/13/2010

1 - U.S. EPA, July 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.
2 - Adjusted dermal RfD = Oral RfD x Oral Absorption Efficiency for Dermal.
3 - Values are for methyl mercury.
ATSDR = Agency for Toxic Substances and Disease Registry
CNS = Central Nervous System
GS = Gastrointestinal
HEAST = Health Effects Assessment Summary Tables
IRIS = Integrated Risk Information System
NA = Not applicable

TABLE 6.1
CANCER TOXICITY DATA -- ORAL/DERMAL
SITE 3 - CAUSEWAY LANDFILL - POND
MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal[1]	Absorbed Cancer Slope Factor for Dermal[2]		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Pesticides								
4,4'-DDD	2.4E-01	$(mg/kg/day)^{-1}$	1	2.4E-01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	5/13/2010
4,4'-DDE	3.4E-01	$(mg/kg/day)^{-1}$	1	3.4E-01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	5/13/2010
4,4'-DDT	3.4E-01	$(mg/kg/day)^{-1}$	1	3.4E-01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	5/13/2010
Dioxin-Like PCBs								
2,3,7,8-TCDD (dioxin-like PCBs)	1.3E+05	$(mg/kg/day)^{-1}$	1	1.3E+05	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	ATSDR	12/2009
Inorganics								
Copper	NA	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	5/13/2010
Mercury	NA	NA	NA	NA	NA	C / Inadequate data of carcinogenicity in humans	IRIS	5/13/2010

1 - U.S. EPA, July 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.
2 - Adjusted cancer slope factor for dermal = Oral cancer slope factor / Oral Absorption Efficiency for Dermal.
ATSDR = Agency for Toxic Substances and Disease Registry
IRIS = Integrated Risk Information System.
NA = Not available.

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CHILD RECREATIONAL FISHER

SITE 3 - CAUSEWAY LANDFILL - POND

MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current
Receptor Population: Recreational Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Fish	Fish	Pond	Mercury	--	--	--	--	--	CNS	1	--	--	1
			TEQ PCB	1E-05	--	--	--	1E-05	NA	3	--	--	3
			4,4'-DDD	6E-08	--	--	--	6E-08	NA	--	--	--	--
			4,4'-DDE	4E-07	--	--	--	4E-07	NA	--	--	--	--
			4,4'-DDT	6E-08	--	--	--	6E-08	Liver	0.008	--	--	0.008
			Chemical Total	2E-05	--	--	--	2E-05		4	--	--	4
		Exposure Point Total						2E-05					4
	Exposure Medium Total							2E-05					4
Medium Total								2E-05					4
Receptor Total							Receptor Risk Total	2E-05				Receptor HI Total	4

Total CNS HI	1
Total Liver HI	0.008
Total NA HI	3

TABLE 9.2.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CHILD SUBSISTENCE FISHER
SITE 3 - CAUSEWAY LANDFILL - POND
MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current
Receptor Population: Subsistence Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Fish	Fish	Pond	Mercury	--	--	--	--	--	CNS	7	--	--	7
			TEQ PCB	7E-05	--	--	--	7E-05	NA	12	--	--	12
			4,4'-DDD	3E-07	--	--	--	3E-07	NA	--	--	--	--
			4,4'-DDE	2E-06	--	--	--	2E-06	NA	--	--	--	--
			4,4'-DDT	3E-07	--	--	--	3E-07	Liver	0.04	--	--	0.04
			Chemical Total	7E-05	--	--	--	7E-05		19	--	--	19
		Exposure Point Total						7E-05					19
	Exposure Medium Total							7E-05					19
Medium Total								7E-05					19
Receptor Total							Receptor Risk Total	7E-05				Receptor HI Total	19

Total CNS HI	7
Total Liver HI	0.04
Total NA HI	12

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT RECREATIONAL MILITARY FISHER

SITE 3 - CAUSEWAY LANDFILL - POND

MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current
Receptor Population: Recreational Military Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Fish	Fish	Pond	Mercury	--	--	--	--	--	CNS	0.4	--	--	0.4
			TEQ PCB	7E-06	--	--	--	7E-06	NA	0.7	--	--	0.7
			4,4'-DDD	3E-08	--	--	--	3E-08	NA	--	--	--	--
			4,4'-DDE	2E-07	--	--	--	2E-07	NA	--	--	--	--
			4,4'-DDT	3E-08	--	--	--	3E-08	Liver	0.002	--	--	0.002
			Chemical Total	8E-06	--	--	--	8E-06		1	--	--	1
		Exposure Point Total						8E-06					1
	Exposure Medium Total							8E-06					1
Medium Total								8E-06					1
Receptor Total							Receptor Risk Total	8E-06				Receptor HI Total	1

Total CNS HI	0.4
Total Liver HI	0.002
Total NA HI	0.7

TABLE 9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT RECREATIONAL CIVILIAN FISHER

SITE 3 - CAUSEWAY LANDFILL - POND

MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current
Receptor Population: Recreational Civilian Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Fish	Fish	Pond	Mercury	--	--	--	--	--	CNS	0.4	--	--	0.4
			TEQ PCB	8E-05	--	--	--	8E-05	NA	0.7	--	--	0.7
			4,4'-DDD	4E-07	--	--	--	4E-07	NA	--	--	--	--
			4,4'-DDE	2E-06	--	--	--	2E-06	NA	--	--	--	--
			4,4'-DDT	3E-07	--	--	--	3E-07	Liver	0.002	--	--	0.002
			Chemical Total	9E-05	--	--	--	9E-05		1	--	--	1
		Exposure Point Total						9E-05					1
	Exposure Medium Total							9E-05					1
Medium Total								9E-05					1
Receptor Total							Receptor Risk Total	9E-05				Receptor HI Total	1

Total CNS HI	0.4
Total Liver HI	0.002
Total NA HI	0.7

5/19/2010

TABLE 9.5.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT SUBSISTENCE FISHER

SITE 3 - CAUSEWAY LANDFILL - POND

MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current
Receptor Population: Subsistence Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Fish	Fish	Pond	Mercury	--	--	--	--	--	CNS	3	--	--	3
			TEQ PCB	7E-04	--	--	--	7E-04	NA	5	--	--	5
			4,4'-DDD	3E-06	--	--	--	3E-06	NA	--	--	--	--
			4,4'-DDE	2E-05	--	--	--	2E-05	NA	--	--	--	--
			4,4'-DDT	3E-06	--	--	--	3E-06	Liver	0.02	--	--	0.02
			Chemical Total	7E-04	--	--	--	7E-04		8	--	--	8
		Exposure Point Total						7E-04					8
	Exposure Medium Total							7E-04					8
Medium Total								7E-04					8
Receptor Total							Receptor Risk Total	7E-04				Receptor HI Total	8

Total CNS HI	3
Total Liver HI	0.02
Total NA HI	5

TABLE 9.6.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - USEPA REGION IV DEFAULT

SITE 3 - CAUSEWAY LANDFILL - POND

MCRD PARRIS ISLAND, SOUTH CAROLINA

Scenario Timeframe: Current
Receptor Population: USEPA Region IV Default
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Fish	Fish	Pond	Mercury	--	--	--	--	--	CNS	1.1	--	--	1
			TEQ PCB	1E-04	--	--	--	1E-04	NA	1.9	--	--	2
			4,4'-DDD	4E-07	--	--	--	4E-07	NA	--	--	--	--
			4,4'-DDE	3E-06	--	--	--	3E-06	NA	--	--	--	--
			4,4'-DDT	4E-07	--	--	--	4E-07	Liver	0.005	--	--	0.005
			Chemical Total	1E-04	--	--	--	1E-04		3	--	--	3
		Exposure Point Total						1E-04					3
	Exposure Medium Total							1E-04					3
Medium Total								1E-04					3
Receptor Total							Receptor Risk Total	1E-04				Receptor HI Total	3

Total CNS HI	1
Total Liver HI	0.005
Total NA HI	2

Appendix D
Ecological Risk Tables

Appendix D.1
RI ERA Supporting Tables

TABLE 7-1

TOXICITY REFERENCE VALUES (TRVs) FOR MAMMAL RECEPTORS
SITE 3 – CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical	Test Species	Endpoint	NOAEL Derived TRV (mg/kg/day)	LOAEL Derived TRV (mg/kg/day)	NOAEL Source of TRV	LOAEL Source of TRV
VOLATILE ORGANIC COMPOUNDS						
2-Butanone	Rat	Neurological effects	173	1730	ATSDR (1991a)	NOAEL*10
Acetone	Rat	Liver and Kidney	10	50	Sample et al. (1996)	Sample et al. (1996)
Carbon Disulfide	Rabbit	Offspring malformations	11	110	IRIS (1991)	NOAEL*10
Chloroform			NA	NA		
SEMIVOLATILE ORGANIC COMPOUNDS						
2-Methylnapthalene[1]	Mouse	Reproduction	1	10	Sample et al. (1996)	Sample et al. (1996)
4-Methylphenol			175	450	ATSDR (1997)	ATSDR (1997)
Acenaphthylene	Mouse	Tumors	1.3	2.6	ERT (1997)	ERT (1997)
Anthracene	Mouse	Tumors	1.3	2.6	ERT (1997)	ERT (1997)
Benzo(a)anthracene[1]	Mouse	Reproduction	1	10	Sample et al. (1996)	Sample et al. (1996)
Benzo(a)pyrene	Mouse	Reproduction	1	10	Sample et al. (1996)	Sample et al. (1996)
Benzo(b)fluoranthene[1]	Mouse	Reproduction	1	10	Sample et al. (1996)	Sample et al. (1996)
Benzo(g,h,i)perylene[1]	Mouse	Reproduction	1	10	Sample et al. (1996)	Sample et al. (1996)
Benzo(k)fluoranthene[1]	Mouse	Reproduction	1	10	Sample et al. (1996)	Sample et al. (1996)
Bis(2-ethylhexyl)phthalate	Mouse	Reproduction	18.3	183	Sample et al. (1996)	Sample et al. (1996)
Butylbenzlphthalate[2]	Mouse	Reproduction	18.3	183	Sample et al. (1996)	Sample et al. (1996)
Carbazole	Mouse	Tumors	1.3	2.6	ERT (1997)	ERT (1997)
Chrysene[1]	Mouse	Reproduction	1	10	Sample et al. (1996)	Sample et al. (1996)
Dibenzofuran	Mouse	Multinuclear hepatocyte	60	125	ATSDR (1991b)	ATSDR (1991b)
Fluoranthene[1]	Mouse	Reproduction	1	10	Sample et al. (1996)	Sample et al. (1996)
Indeno(1,2,3-cd)pyrene[1]	Mouse	Reproduction	1	10	Sample et al. (1996)	Sample et al. (1996)

TABLE 7-1

TOXICITY REFERENCE VALUES (TRVs) FOR MAMMAL RECEPTORS
SITE 3 – CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical	Test Species	Endpoint	NOAEL Derived TRV (mg/kg/day)	LOAEL Derived TRV (mg/kg/day)	NOAEL Source of TRV	LOAEL Source of TRV
Phenanthrene	Mouse	Tumors	1.3	2.6	ERT (1997)	ERT (1997)
Pyrene[1]	Mouse	Reproduction	1	10	Sample et al. (1996)	Sample et al. (1996)
PESTICIDES/PCBs						
4,4'-DDD[3]	Rat	Reproduction	0.8	4	Sample et al. (1996)	Sample et al. (1996)
4,4'-DDE	Hamster	Systemic	20	41.5	ATSDR 1988	ATSDR 1988
4,4'-DDT	Rat	Reproduction	0.8	4	Sample et al. (1996)	Sample et al. (1996)
Aroclor-1254	Mouse	Reproduction	0.068	0.68	Sample et al. (1996)	Sample et al. (1996)
Aroclor-1260[4]	Mouse	Reproduction	0.068	0.68	Sample et al. (1996)	Sample et al. (1996)
Alpha-Chlordane[5]	Mouse	Reproduction	4.6	9.2	Sample et al. (1996)	Sample et al. (1996)
Gamma-Chlordane[5]	Mouse	Reproduction	4.6	9.2	Sample et al. (1996)	Sample et al. (1996)
METALS AND INORGANIC COMPOUNDS						
Aluminum	Mouse	Reproduction	1.93	19.3	Sample et al. (1996)	Sample et al. (1996)
Arsenic	Mouse	Reproduction	0.126	1.26	Sample et al. (1996)	Sample et al. (1996)
Barium	Rat	Growth, hypertension	5.1	51	Sample et al. (1996)	NOAEL*10
Beryllium	Rat	Longevity, weight loss	0.66	6.6	Sample et al. (1996)	NOAEL*10
Cobalt			1	10	ERT (1997)	NOAEL*10
Copper	Mink	Reproduction	11.7	15.14	Sample et al. (1996)	Sample et al. (1996)
Cyanide	Rat	Reproduction	68.7	687	Sample et al. (1996)	NOAEL*10
Iron	Rabbit		50	500	ERT (1997)	NOAEL*10
Lead	Rat	Reproduction	8	80	Sample et al. (1996)	Sample et al. (1996)
Manganese	Rat	Reproduction	88	284	Sample et al. (1996)	Sample et al. (1996)
Mercury	Mink	Reproduction	0.015	0.025	Sample et al. (1996)	Sample et al. (1996)
Selenium	Rat	Reproduction	0.2	0.33	Sample et al. (1996)	Sample et al. (1996)

TABLE 7-1

TOXICITY REFERENCE VALUES (TRVs) FOR MAMMAL RECEPTORS
SITE 3 – CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical	Test Species	Endpoint	NOAEL Derived TRV (mg/kg/day)	LOAEL Derived TRV (mg/kg/day)	NOAEL Source of TRV	LOAEL Source of TRV
Thallium	Rat	Reproduction	0.0074	0.074	Sample et al. (1996)	Sample et al. (1996)
Vanadium	Rat	Reproduction	0.21	2.1	Sample et al. (1996)	Sample et al. (1996)
Zinc	Rat	Reproduction	160	320	Sample et al. (1996)	Sample et al. (1996)

1 Benzo(a)pyrene TRV used as a surrogate for high molecular weight PAHs.
2 Bis(2-ethylhexyl)phthalate TRV used as a surrogate for butylbenzlphthalate.
3 4,4'–DDT TRV used as a surrogate for 4,4'-DDD.
4 Aroclor 1254 used as a surrogate for Aroclor 1260.
5 Chlordane used as a surrogate for alpha-chlordane and gamma-chlordane.

TABLE 7-2

TOXICITY REFERENCE VALUES (TRVs) FOR BIRDS AND FISH
SITE 3 – CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical	Test Species	Endpoint	NOAEL Derived TRV (mg/kg/day)	LOAEL Derived TRV (mg/kg/day)	NOAEL Source of TRV	LOAEL Source of TRV
VOLATILE ORGANIC COMPOUNDS						
2-Butanone			NA	NA		
Acetone			NA	NA		
Carbon Disulfide			NA	NA		
Chloroform			NA	NA		
SEMIVOLATILE ORGANIC COMPOUNDS						
2-Methylnapthalene	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)
4-Methylphenol			NA	NA		
Acenaphthylene	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)
Anthracene	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)
Benzo(a)anthracene	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)
Benzo(a)pyrene	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)
Benzo(b)fluoranthene	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)
Benzo(g,h,i)perylene	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)
Benzo(k)fluoranthene	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)

TABLE 7-2

TOXICITY REFERENCE VALUES (TRVs) FOR BIRDS AND FISH
SITE 3 – CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical	Test Species	Endpoint	NOAEL Derived TRV (mg/kg/day)	LOAEL Derived TRV (mg/kg/day)	NOAEL Source of TRV	LOAEL Source of TRV
Bis(2-ethylhexyl)phthalate	Ringed dove	Reproduction	1.1	11	Sample et al. (1996)	NOAEL*10
Carbazole	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)
Chrysene	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)
Dibenzofuran			NA	NA		
Fluoranthene	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)
Indeno(1,2,3-cd)pyrene	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)
Phenanthrene	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)
Pyrene	European Starlings	Body weight, hemoglobin	10	100	ERT (1997)	NOAEL*10
	Channel Catfish	Mortality	0.3	3	ERT (1997)	ERT (1997)
PESTICIDES/PCBs						
Aroclor-1254	Ring-necked Pheasant	Reproduction	0.18	1.8	Sample et al. (1996)	Sample et al. (1996)
Aroclor-1260[1]	Ring-necked Pheasant	Reproduction	0.18	1.8	Sample et al. (1996)	Sample et al. (1996)
Alpha-Chlordane[2]	Red-winged Blackbird	Mortality	2.14	10.7	Sample et al. (1996)	Sample et al. (1996)
Gamma-Chlordane[2]	Red-winged Blackbird	Mortality	2.14	10.7	Sample et al. (1996)	Sample et al. (1996)
4,4'-DDD[3]	Brown Pelican	Reproduction	0.0028	0.028	ERT (1997)	NOAEL*10

TABLE 7-2

TOXICITY REFERENCE VALUES (TRVs) FOR BIRDS AND FISH
SITE 3 – CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical	Test Species	Endpoint	NOAEL Derived TRV (mg/kg/day)	LOAEL Derived TRV (mg/kg/day)	NOAEL Source of TRV	LOAEL Source of TRV
4,4'-DDE[3]	Brown Pelican	Reproduction	0.0028	0.028	ERT (1997)	NOAEL*10
4,4'-DDT	Brown Pelican	Reproduction	0.0028	0.028	ERT (1997)	NOAEL*10
METALS AND INORGANIC COMPOUNDS						
Aluminum	Ringed Dove	Reproduction	109.7	1097	Sample et al. (1996)	NOAEL*10
Antimony			NA	NA		
Arsenic	Mallard duck	Mortality	5.14	12.84	Sample et al. (1996)	Sample et al. (1996)
	Rainbow Trout	Body Weight, Growth	0.59	7.1	ERT (1997)	ERT (1997)
Barium	1-day old chicks	Mortality	20.8	41.7	Sample et al. (1996)	Sample et al. (1996)
Beryllium			NA	NA		
Chromium	Black Duck	Reproduction	1	5	Sample et al. (1996)	Sample et al. (1996)
	Rainbow Trout	Body Weight, Growth	0.02	0.12	ERT (1997)	ERT (1997)
Cobalt			1	10	ERT (1997)	NOAEL*10
Copper	1-day old chicks	Growth, Mortality	47	61.7	Sample et al. (1996)	Sample et al. (1996)
Cyanide, total	Chicken		4.5	45	ERT (1997)	NOAEL*10
Iron	Chicken		100	1000	ERT (1997)	NOAEL*10
Lead	Japanese Quail	Reproduction	1.13	11.3	Sample et al. (1996)	Sample et al. (1996)
Manganese	Japanese Quail	Growth,Behavior	977	9770	Sample et al. (1996)	NOAEL*10
Mercury	Mallard Duck	Reproduction	0.0064	0.064	Sample et al. (1996)	Sample et al. (1996)
	Rainbow Trout	Growth	0.008	0.94	ERT (1997)	ERT (1997)
Nickel	Mallard duckling	Growth, Mortality	77.4	107	Sample et al. (1996)	Sample et al. (1996)
Selenium	Mallard duck	Reproduction	0.4	0.8	Sample et al. (1996)	Sample et al. (1996)
Silver			NA	NA		

TABLE 7-2

TOXICITY REFERENCE VALUES (TRVs) FOR BIRDS AND FISH
SITE 3 – CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Chemical	Test Species	Endpoint	NOAEL Derived TRV (mg/kg/day)	LOAEL Derived TRV (mg/kg/day)	NOAEL Source of TRV	LOAEL Source of TRV
Thallium	Pheasant	Mortality	0.47	4.7	LOAEL/10	LD_{50}/5; Hudson et al. (1984)
Vanadium	Mallard duck	Mortality	11.4	114	Sample et al. (1996)	NOAEL*10
Zinc	White leghorn hens	Reproduction	14.5	131	Sample et al. (1996)	Sample et al. (1996)

1 TRV for Aroclor 1254
2 TRV for total chlordane
3 TRV for DDT

TABLE 7-3

EXPOSURE PARAMETERS FOR REPRESENTATIVE ECOLOGICAL RECEPTORS
SITE 3 – CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Receptor	Representative Group	Body Weight[1] (grams)	Food Ingestion[1,2] (grams/day)	Assumed Diet for Exposure Assessment[1]	Home Range[1] (acres)
Short-tailed shrew (*Blarina carolinensis*)	Insectivorous mammal	9.73[3]	5.2	90% invertebrates 10% soil	0.96[1] to 2.4[3]
Cotton mouse (*Peromyscus gossypnius*)	Herbivorous Mammal	31[4]	8.6	98% vegetation 2% soil[5]	0.05 to 0.3[5]
Raccoon (*Procyon lotor*)	Omnivorous Mammal	3990	856	90.6% aquatic invertebrates 9.4% sediment	96 to 161
American robin (*Turdus migratorius*)	Omnivorous Bird	77.3	69	35% invertebrates 60% vegetation 5% soil[6]	0.5 to 2.1 (nesting season)
Great Blue Heron (*Ardea herodias*)	Piscivorous Bird	2229	401	100% fish soil, sediment: none[6]	1.5 to 20 (feeding territory) [13]
Bald Eagle (*Haliaeetus leucocephalus*)	Piscivorous Bird	3750	450	100% fish soil, sediment: none[6]	2500-3700[7]
Red-tailed hawk (*Buteo jamaicensis*)	Carnivorous Bird	1126	126	100% prey soil, sediment: none[6]	940 to 2440
Mummichog (*Fundulus heteroclitus*)	Forage fish	3.0[8]	0.174[8]	N/A; exposure assumed equal to sediment concentrations	40-400 yds. in tidal creeks[9]
Red drum (*Sciaenops ocellatus*)	Upper trophic level fish	1400[10]	28[11]	85% prey, 15% sediment[12]	not available

1 Exposure parameters are from EPA (1993) unless otherwise noted.
2 Food ingestion includes intended food items and incidentally ingested soil or sediment. For example, a shrew would be expected to consume 4.7 g invertebrates plus 0.5 g soil per day. See section 7.4.2.1 of text for ingestion formulas.
3 Cothran et al (1991)
4 Lowery (1974)
5 Based on deer mouse (*Peromyscus maniculatus*)
6 Sample and Suter (1994)
7 Stalmaster (1987)
8 Iannuzzi et al (1996)
9 Abraham (1985)
10 Wenner (1992)
11 Evans and Engel (1994)
12 Gerking (1994). See section 7.3.3.9 of text.
13 Actual home range is much greater.

TABLE 7-4

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 3 – SURFACE WATER
PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 2

Analyte	Frequency of Detection	Range of Detection		Location of Maximum	EPA Region 4 Screening Level	Maximum Hazard Quotient	Selected as COPC (Yes/No?)
		Minimum	Maximum				
VOLATILE ORGANIC COMPOUNDS (µg/L)							
Acetone	1/1	3	3	PAI-03-SW-023	NA	NA	Yes
SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)							
Anthracene	1/20	0.38	0.38	PAI-03-SW-014	23.5	0.02	No
Benzo(a)anthracene	1/20	0.66	0.66	PAI-03-SW-014	NA	NA	Yes
Benzo(a)pyrene	2/20	0.075	0.72	PAI-03-SW-014	NA	NA	Yes
Benzo(b)fluoranthene	2/20	0.06	0.67	PAI-03-SW-014	NA	NA	Yes
Benzo(g,h,i)perylene	1/20	0.89	0.89	PAI-03-SW-014	NA	NA	Yes
Benzo(k)fluoranthene	2/20	0.025	0.25	PAI-03-SW-014	NA	NA	Yes
Bis(2-Ethylhexyl)phthalate	6/20	2	7	PAI-03-SW-025	NA	NA	Yes
Butylbenzyl Phthalate	1/20	5	5	PAI-03-SW-028	29.4	0.17	No
Chrysene	2/20	0.09	1.2	PAI-03-SW-014	NA	NA	Yes
Fluoranthene	3/20	0.1	1.9	PAI-03-SW-014	1.6	1.2	Yes
Indeno(1,2,3-cd)pyrene	2/20	0.075	0.39	PAI-03-SW-014	NA	NA	Yes
Phenanthrene	3/20	0.05	1.4	PAI-03-SW-014	23.5	0.06	No
Pyrene	1/20	1.3	1.3	PAI-03-SW-014	NA	NA	Yes
METALS/INORGANICS (µg/L)							
Aluminum	18/20	242	88600	PAI-03-SW-027	NA	NA	Yes
Antimony	4/20	1.8	4.2	PAI-03-SW-019-F	NA	NA	Yes
Arsenic	2/20	2.3	96.1	PAI-03-SW-027	36	2.7	Yes
Barium	20/20	13	279	PAI-03-SW-028-F	NA	NA	Yes
Beryllium	1/20	4.4	4.4	PAI-03-SW-027	NA	NA	Yes
Cadmium	1/20	2	2	PAI-03-SW-027	9.3	0.2	No
Chromium	3/20	0.79	164	PAI-03-SW-027	103	1.6	Yes
Cobalt	1/20	21.1	21.1	PAI-03-SW-027	NA	NA	Yes
Copper	8/20	1	152	PAI-03-SW-027	2.9	52.4	Yes
Iron	18/20	163	110000	PAI-03-SW-027	NA	NA	Yes
Lead	1/20	132	132	PAI-03-SW-027	8.5	15.5	Yes
Manganese	19/20	5.3	840	PAI-03-SW-027	NA	NA	Yes

TABLE 7-4

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 3 – SURFACE WATER
PARRIS ISLAND, SOUTH CAROLINA
PAGE 2 OF 2

Analyte	Frequency of Detection	Range of Detection		Location of Maximum	EPA Region 4 Screening Level	Maximum Hazard Quotient	Selected as COPC (Yes/No?)
		Minimum	Maximum				
Mercury	1/20	0.15	0.15	PAI-03-SW-027	0.025	6.0	Yes
Nickel	1/20	39.8	39.8	PAI-03-SW-027	8.3	4.8	Yes
Silver	4/20	0.68	2.1	PAI-03-SW-021	0.23	9.1	Yes
Vanadium	1/20	269	269	PAI-03-SW-027	NA	NA	Yes
Zinc	18/20	12.7	294	PAI-03-SW-027	86	3.4	Yes

NA = Not Available.

TABLE 7-5

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 3 – SEDIMENT
PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 3

Analyte	Frequency of Detection	Range of Detection		Location of Maximum	EPA Region 4 Screening Level	Maximum Hazard Quotient	Selected as COPC (Yes/No?)
		Minimum	Maximum				
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
2-Butanone	6/17	8	61	PAI-03-SD-014-01	NA	NA	Yes
Acetone	2/6	150	170	PAI-03-SD-026-01	NA	NA	Yes
Carbon Disulfide	6/21	3	40	PAI-03-SD-014-01	NA	NA	Yes
Chloroform	2/21	1	1	PAI-03-SD-015-01, PAI-03-SD-016-01	NA	NA	Yes
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)							
Anthracene	4/21	3.7	770	PAI-03-SD-022-01	46.9	16.4	Yes
Benzo(a)anthracene	6/21	5.1	1200	PAI-03-SD-022-01	74.8	16.0	Yes
Benzo(a)pyrene	6/21	8.1	1200	PAI-03-SD-022-01	88.8	13.5	Yes
Benzo(b)fluoranthene	13/21	1.8	990	PAI-03-SD-022-01	655.0	1.5	Yes
Benzo(g,h,i)perylene	2/21	24	570	PAI-03-SD-022-01	655.0	0.9	No
Benzo(k)fluoranthene	5/21	3	420	PAI-03-SD-022-01	655.0	0.6	No
Carbazole	1/21	570	570	PAI-03-SD-022-01	NA	NA	Yes
Chrysene	13/21	3.2	1900	PAI-03-SD-022-01	108.0	17.6	Yes
Dibenzofuran	1/21	190	190	PAI-03-SD-022-01	NA	NA	Yes
Fluoranthene	9/21	15	3500	PAI-03-SD-022-01	113.0	31.0	Yes
Fluorene	1/21	13	13	PAI-03-SD-027-01	21.2	0.6	No
Indeno(1,2,3-cd)pyrene	6/21	5.8	660	PAI-03-SD-022-01	655.0	1.0	Yes
Phenanthrene	9/21	5.8	2400	PAI-03-SD-022-01	86.7	27.7	Yes
Pyrene	8/21	11	2700	PAI-03-SD-022-01	153.0	17.6	Yes

TABLE 7-5

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 3 – SEDIMENT
PARRIS ISLAND, SOUTH CAROLINA

Analyte	Frequency of Detection	Range of Detection		Location of Maximum	EPA Region 4 Screening Level	Maximum Hazard Quotient	Selected as COPC (Yes/No?)
		Minimum	Maximum				
PESTICIDES AND PCBs (µg/kg)							
4,4'-DDD	2/21	40	290	PAI-03-SD-014-01	1.22	237.7	Yes
4,4'-DDE	1/21	45	45	PAI-03-SD-014-01	2.07	21.7	Yes
4,4'-DDT	1/21	34	34	PAI-03-SD-021-01	1.19	28.6	Yes
Alpha-Chlordane	1/21	28	28	PAI-03-SD-028-01	0.5[a]	56	Yes
Aroclor-1254	3/21	65	250	PAI-03-SD-020-01	21.6[b]	11.6	Yes
Aroclor-1260	2/21	45	70	PAI-03-SD-015-01	21.6[b]	3.2	Yes
Gamma-Chlordane	1/21	28	28	PAI-03-SD-028-01	0.5[a]	56	Yes
METALS AND INORGANIC COMPOUNDS (mg/kg)							
Aluminum	21/21	1510	29700	PAI-03-SD-026-01	NA	NA	Yes
Antimony	3/21	0.34	0.74	PAI-03-SD-014-01	2.0	0.4	No
Arsenic	16/21	2.3	19.8	PAI-03-SD-024-01	7.24	2.7	Yes
Barium	16/21	3.6	53.8	PAI-03-SD-022-01	NA	NA	Yes
Beryllium	11/21	0.29	1.4	PAI-03-SD-026-01	NA	NA	Yes
Cadmium	10/21	0.12	0.44	PAI-03-SD-010-01	0.676	0.7	No
Chromium	21/21	3.3	50.3	PAI-03-SD-026-01	52.3	0.96	No
Cobalt	19/21	0.11	5.6	PAI-03-SD-026-01	NA	NA	Yes
Copper	21/21	1.8	46.9	PAI-03-SD-020-01	18.7	2.5	Yes
Cyanide	1/21	0.71	0.71	PAI-03-SD-018-01	NA	NA	Yes
Iron	21/21	1100	28000	PAI-03-SD-024-01	NA	NA	Yes
Lead	21/21	6.4	105	PAI-03-SD-017-01	30.2	3.5	Yes
Manganese	21/21	9.7	205	PAI-03-SD-026-01	NA	NA	Yes

TABLE 7-5

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 3 – SEDIMENT
PARRIS ISLAND, SOUTH CAROLINA

Analyte	Frequency of Detection	Range of Detection		Location of Maximum	EPA Region 4 Screening Level	Maximum Hazard Quotient	Selected as COPC (Yes/No?)
		Minimum	Maximum				
Mercury	6/21	0.05	0.35	PAI-03-SD-028-01	0.13	2.7	Yes
Nickel	19/21	0.42	13.9	PAI-03-SD-020-01	15.9	0.9	No
Selenium	7/21	0.32	1.1	PAI-03-SD-028-01	NA	NA	Yes
Silver	1/21	0.13	0.13	PAI-03-SD-020-01	0.733	0.2	No
Thallium	1/21	0.62	0.62	PAI-03-SD-027-01	NA	NA	Yes
Vanadium	21/21	2.6	63.7	PAI-03-SD-026-01	NA	NA	Yes
Zinc	21/21	5.2	159	PAI-03-SD-020-01	124.0	1.3	Yes

NA = Not Available.
a ESV for total chlordane
b ESV for total PCBs

TABLE 7-6

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 3 – SURFACE SOIL
PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 3

Analyte	Frequency of Detection	Range of Detection		EPA Region 4 Screening Level	Maximum Hazard Quotient	Selected as COPC (Yes/No?)
		Minimum	Maximum			
VOLATILE ORGANIC COMPOUNDS (µg/kg)						
2-Butanone	1/16	360	360	NA	NA	Yes
Acetone	2/6	120	240	NA	NA	Yes
Chloroform	4/16	1	2	1.0	2	Yes
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)						
2-Methylnaphthalene	1/15	300	300	NA	NA	Yes
4-Methylphenol	1/15	120	120	NA	NA	Yes
Acenaphthene	1/16	4000	4000	20000	0.2	No
Acenaphthylene	1/16	1800	1800	100	18	Yes
Anthracene	6/16	1.7	340	100	3.4	Yes
Benzo(a)anthracene	10/16	3	3000	100	30	Yes
Benzo(a)pyrene	10/16	4.1	4000	100	40	Yes
Benzo(b)fluoranthene	15/16	2.2	3400	100	34	Yes
Benzo(g,h,i)perylene	5/16	9.3	2500	100	25	Yes
Benzo(k)fluoranthene	11/16	1.7	1300	100	13	Yes
Bis(2-Ethylhexyl)phthalate	1/15	2300	2300	NA	NA	Yes
Carbazole	3/15	48	670	NA	NA	Yes
Chrysene	13/16	3.6	2900	100	29	Yes
Dibenzofuran	1/15	340	340	NA	NA	Yes
Fluoranthene	14/16	6.4	5100	100	51	Yes
Indeno(1,2,3-cd)pyrene	10/16	2.6	2600	100	26	Yes
Phenanthrene	14/16	2.2	1200	100	12	Yes
Pyrene	10/16	13	4500	100	45	Yes

TABLE 7-6

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 3 – SURFACE SOIL
PARRIS ISLAND, SOUTH CAROLINA
PAGE 2 OF 3

Analyte	Frequency of Detection	Range of Detection		EPA Region 4 Screening Level	Maximum Hazard Quotient	Selected as COPC (Yes/No?)
		Minimum	Maximum			
PESTICIDES/PCBs (µg/kg)						
4,4'-DDE	1/16	4.1	4.1	2.5	1.6	Yes
4,4'-DDT	2/16	1.8	4.5	2.5	1.8	Yes
Alpha-Chlordane	1/16	96	96	NA	NA	Yes
Aroclor-1254	1/16	56	56	20	2.8	Yes
Aroclor-1260	4/16	11	100	20	5	Yes
Gamma-Chlordane	1/16	53	53	NA	NA	Yes
METALS AND INORGANIC COMPOUNDS (mg/kg)						
Aluminum	16/16	2370	10800	50	216	Yes
Antimony	2/16	0.17	0.33	3.5	0.09	No
Arsenic	16/16	0.44	11.8	10	1.2	Yes
Barium	16/16	5.8	81.2	165	0.5	No
Beryllium	3/16	0.11	0.58	1.1	0.5	No
Cadmium	6/16	0.04	0.53	1.6	0.3	No
Chromium	16/16	3.5	15.9	64	0.2	No
Cobalt	16/16	0.14	1.7	20	0.09	No
Copper	13/16	1.3	10.7	40	0.3	No
Iron	16/16	2180	7370	200	36.9	Yes
Lead	16/16	5.5	264	50	5.3	Yes
Manganese	16/16	8.1	66.9	100	0.7	No
Mercury	6/16	0.0375	0.43	0.1	4.3	Yes
Nickel	16/16	0.39	6.1	30	0.2	No
Selenium	2/16	0.28	0.41	0.81	0.5	No

TABLE 7-6

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 3 – SURFACE SOIL
PARRIS ISLAND, SOUTH CAROLINA

Analyte	Frequency of Detection	Range of Detection		EPA Region 4 Screening Level	Maximum Hazard Quotient	Selected as COPC (Yes/No?)
		Minimum	Maximum			
Silver	1/16	0.09	0.09	2.0	0.05	No
Vanadium	16/16	4.7	21.4	2.0	10.7	Yes
Zinc	16/16	5.7	205	50	4.1	Yes

NA = Not Available.

TABLE 7-7

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 3 – GROUNDWATER
PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 2

Analyte	Frequency of Detection	Range of Detection		EPA Region 4 Screening Level	Maximum Hazard Quotient	Selected as COPC (Yes/No?)
		Minimum	Maximum			
VOLATILE ORGANIC COMPOUNDS (µg/L)						
Benzene	2/4	0.3	21	109	0.2	No
Carbon Disulfide	1/4	0.3	0.3	NA	NA	Yes
Chlorobenzene	2/4	0.6	130	105	1.2	Yes
Chloroform	1/4	0.3	0.3	815	0.0004	No
Ethylbenzene	1/4	0.3	0.3	4.3	0.07	No
Toluene	2/4	0.3	0.3	37	0.008	No
Xylenes, Total	1/4	0.3	0.3	NA	NA	Yes
1,4-Dichlorobenzene	1/4	10	10	19.9	0.5	No
2-Methylnaphthalene	1/4	1	1	NA	NA	Yes
4-Methylphenol	1/4	73	73	NA	NA	Yes
Acenaphthene	1/4	2	2	9.7	0.2	No
Anthracene	1/4	1	1	23.5	0.04	No
Bis(2-Ethylhexyl)phthalate	3/4	1	1	NA	NA	Yes
Fluorene	1/4	1	1	23.5	0.04	No
N-Nitrosodiphenylamine	1/4	1	1	33,000	3.0E-05	No
Naphthalene	2/4	1	1	23.5	0.04	No
Phenanthrene	1/4	1	1	23.5	0.04	No
PESTICIDES/PCBs (µg/L)						
alpha-BHC	1/4	0.12	0.12	1400	8.6E-05	No

TABLE 7-7

SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SITE 3 – GROUNDWATER
PARRIS ISLAND, SOUTH CAROLINA

Analyte	Frequency of Detection	Range of Detection		EPA Region 4 Screening Level	Maximum Hazard Quotient	Selected as COPC (Yes/No?)
		Minimum	Maximum			
METALS AND INORGANIC COMPOUNDS (µg/L)						
Arsenic	4/4	1.2	34.5	36	0.96	No
Barium	4/4	93.3	901	NA	NA	Yes
Chromium	2/4	7.6	27	103	0.3	No
Iron	3/3	14600	32600	NA	NA	Yes
Manganese	3/3	112	711	NA	NA	Yes
Thallium	1/4	3.8	3.8	21.3	0.2	No

NA = Not Available.

TABLE 7-9

RESULTS OF FOOD CHAIN MODELING
TERRESTRIAL RECEPTORS
MAXIMUM CONCENTRATIONS
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Ecological Contaminant of Potential Concern	Shrew		Mouse		Robin		Hawk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
SEMIVOLATILE ORGANIC COMPOUNDS								
2-Methylnaphthalene	2.33E-02	2.33E-03	1.11E-03	1.11E-04	1.92E-03	1.92E-04	2.86E-05	2.86E-06
4-Methylphenol	3.68E-04	1.43E-04	9.51E-05	3.70E-05	NA	NA	NA	NA
Acenaphthylene	1.08E-01	5.38E-02	5.10E-03	2.55E-03	1.15E-02	1.15E-03	1.71E-04	1.71E-05
Anthracene	2.03E-02	1.02E-02	9.64E-04	4.82E-04	2.17E-03	2.17E-04	3.24E-05	3.24E-06
Benzo(a)anthracene	2.33E-01	2.33E-02	1.11E-02	1.11E-03	1.92E-02	1.92E-03	2.86E-04	2.86E-05
Benzo(a)pyrene	3.11E-01	3.11E-02	1.47E-02	1.47E-03	2.55E-02	2.55E-03	3.81E-04	3.81E-05
Benzo(b)fluoranthene	2.64E-01	2.64E-02	1.25E-02	1.25E-03	2.17E-02	2.17E-03	3.24E-04	3.24E-05
Benzo(g,h,i)perylene	1.94E-01	1.94E-02	9.21E-03	9.21E-04	1.60E-02	1.60E-03	2.38E-04	2.38E-05
Benzo(k)fluoranthene	1.01E-01	1.01E-02	4.79E-03	4.79E-04	8.30E-03	8.30E-04	1.24E-04	1.24E-05
Bis(2-ethylhexyl)phthalate	9.77E-03	9.77E-04	9.12E-04	9.12E-05	1.63E-01	1.63E-02	1.46E-03	1.46E-04
Carbazole	4.01E-02	2.00E-02	5.07E-03	2.54E-03	5.90E-03	5.90E-04	5.74E-05	5.74E-06
Chrysene	2.25E-01	2.25E-02	1.07E-02	1.07E-03	1.85E-02	1.85E-03	2.76E-04	2.76E-05
Dibenzofuran	4.40E-04	2.11E-04	4.11E-05	1.97E-05	NA	NA	NA	NA
Fluoranthene	3.96E-01	3.96E-02	1.88E-02	1.88E-03	3.26E-02	3.26E-03	4.85E-04	4.85E-05
Indeno(1,2,3-cd)pyrene	2.02E-01	2.02E-02	9.58E-03	9.58E-04	1.66E-02	1.66E-03	2.47E-04	2.47E-05
Phenanthrene	7.18E-02	3.59E-02	3.40E-03	1.70E-03	7.66E-03	7.66E-04	1.14E-04	1.14E-05
Pyrene	3.50E-01	3.50E-02	1.66E-02	1.66E-03	2.87E-02	2.87E-03	4.28E-04	4.28E-05
PESTICIDES/PCBs								
4,4'-DDE	1.79E-04	8.63E-05	8.47E-07	4.08E-07	8.51E-01	8.51E-02	1.68E-01	1.68E-02
4,4'-DDT	1.85E-03	3.70E-04	2.33E-05	4.65E-06	3.67E-01	3.67E-02	6.26E-02	6.26E-03
alpha-chlordane	1.72E-02	8.61E-03	8.23E-05	4.12E-05	2.46E-02	4.93E-03	2.22E-03	4.44E-04
gamma-chlordane	9.51E-03	4.76E-03	4.54E-05	2.27E-05	1.36E-02	2.72E-03	1.23E-03	2.45E-04
Aroclor-1254	**2.35E+00**	2.35E-01	1.57E-02	1.57E-03	5.98E-01	5.98E-02	3.92E-01	3.92E-02
Aroclor-1260	**4.19E+00**	4.19E-01	2.81E-02	2.81E-03	**1.07E+00**	1.07E-01	6.99E-01	6.99E-02
METALS AND INORGANICS								
Aluminum	**4.43E+02**	**4.43E+01**	**1.61E+01**	1.61E+00	**6.07E+00**	6.07E-01	2.22E-02	2.22E-03
Arsenic	**1.51E+01**	**1.51E+00**	**1.51E+00**	1.51E-01	3.84E-01	1.54E-01	4.13E-03	1.66E-03
Iron	**1.06E+01**	**1.06E+00**	**2.04E+01**	**2.04E+00**	**4.36E+01**	**4.36E+00**	**4.28E+00**	4.28E-01
Lead	**6.00E+00**	6.00E-01	5.51E-01	5.51E-02	**4.26E+01**	**4.26E+00**	7.22E-02	7.22E-03
Mercury	**2.50E+01**	**1.50E+01**	7.81E-01	4.69E-01	**4.50E+01**	**4.50E+00**	7.04E-02	7.04E-03
Vanadium	**7.40E+00**	7.40E-01	2.98E-01	2.98E-02	1.08E-01	1.08E-02	5.52E-04	5.52E-05
Zinc	**2.05E+00**	**1.02E+00**	1.10E-01	5.49E-02	**1.94E+01**	**2.15E+00**	**6.33E+00**	7.01E-01

NA = NOAEL/LOAEL not available

TABLE 7-10

RESULTS OF FOOD CHAIN MODELING
TERRESTRIAL RECEPTORS
MEAN CONCENTRATIONS
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Ecological Contaminant of Potential Concern	Shrew		Mouse		Robin		Hawk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Semivolatile Organic Compounds								
2-Methylnaphthalene	1.45E-02	1.45E-03	6.89E-04	6.89E-05	1.19E-03	1.19E-04	1.78E-05	1.78E-06
4-Methylphenol	5.36E-04	2.08E-04	1.39E-04	5.39E-05	NA	NA	NA	NA
Acenaphthylene	2.10E-02	1.05E-02	9.93E-04	4.97E-04	2.24E-03	2.24E-04	3.33E-05	3.33E-06
Anthracene	1.99E-03	9.94E-04	9.42E-05	4.71E-05	2.12E-04	2.12E-05	3.16E-06	3.16E-07
Benzo(a)anthracene	1.75E-02	1.75E-03	8.29E-04	8.29E-05	1.44E-03	1.44E-04	2.14E-05	2.14E-06
Benzo(a)pyrene	2.25E-02	2.25E-03	1.07E-03	1.07E-04	1.85E-03	1.85E-04	2.76E-05	2.76E-06
Benzo(b)fluoranthene	1.92E-02	1.92E-03	9.10E-04	9.10E-05	1.58E-03	1.58E-04	2.35E-05	2.35E-06
Benzo(g,h,i)perylene	1.54E-02	1.54E-03	7.31E-04	7.31E-05	1.27E-03	1.27E-04	1.89E-05	1.89E-06
Benzo(k)fluoranthene	7.52E-03	7.52E-04	3.56E-04	3.56E-05	6.17E-04	6.17E-05	9.20E-06	9.20E-07
Bis(2-ethylhexyl)phthalate	1.36E-03	1.36E-04	1.27E-04	1.27E-05	2.26E-02	2.26E-03	2.02E-04	2.02E-05
Carbazole	1.16E-02	5.81E-03	1.47E-03	7.36E-04	1.71E-03	1.71E-04	1.66E-05	1.66E-06
Chrysene	1.79E-02	1.79E-03	8.49E-04	8.49E-05	1.47E-03	1.47E-04	2.19E-05	2.19E-06
Dibenzofuran	2.46E-04	1.18E-04	2.30E-05	1.10E-05	NA	NA	NA	NA
Fluoranthene	3.22E-02	3.22E-03	1.52E-03	1.52E-04	2.64E-03	2.64E-04	3.94E-05	3.94E-06
Indeno(1,2,3-cd)pyrene	1.50E-02	1.50E-03	7.13E-04	7.13E-05	1.23E-03	1.23E-04	1.84E-05	1.84E-06
Phenanthrene	7.12E-03	3.56E-03	3.37E-04	1.69E-04	7.60E-04	7.60E-05	1.13E-05	1.13E-06
Pyrene	2.80E-02	2.80E-03	1.33E-03	1.33E-04	2.30E-03	2.30E-04	3.43E-05	3.43E-06
PESTICIDES/PCBs								
4,4'-DDE	5.07E-04	2.44E-04	2.40E-06	1.16E-06	**2.41E+00**	2.41E-01	4.76E-01	4.76E-02
4,4'-DDT	4.80E-03	9.60E-04	6.04E-05	1.21E-05	9.52E-01	9.52E-02	1.63E-01	1.63E-02
alpha-chlordane	1.72E-02	8.61E-03	8.23E-05	4.11E-05	2.46E-02	4.92E-03	2.22E-03	4.44E-04
gamma-chlordane	1.67E-02	8.37E-03	8.00E-05	4.00E-05	2.39E-02	4.79E-03	2.16E-03	4.31E-04
Aroclor-1254	3.24E-01	3.24E-02	2.17E-03	2.17E-04	8.25E-02	8.25E-03	5.41E-02	5.41E-03
Aroclor-1260	5.71E-01	5.71E-02	3.82E-03	3.82E-04	1.45E-01	1.45E-02	9.52E-02	9.52E-03
METALS AND INORGANICS								
Aluminum	**2.36E+02**	**2.36E+01**	**8.58E+00**	8.58E-01	**3.23E+00**	3.23E-01	1.18E-02	1.18E-03
Arsenic	**2.14E+00**	2.14E-01	2.13E-01	2.13E-02	5.41E-02	2.17E-02	5.83E-04	2.34E-04
Iron	**6.89E+00**	6.89E-01	**1.33E+01**	**1.33E+00**	**2.83E+01**	**2.83E+00**	**2.78E+00**	2.78E-01
Lead	7.04E-01	7.04E-02	6.46E-02	6.46E-03	**5.00E+00**	5.00E-01	8.47E-03	8.47E-04
Mercury	**3.33E+00**	**2.00E+00**	1.04E-01	6.25E-02	**6.00E+00**	6.00E-01	9.39E-03	9.39E-04
Vanadium	**3.61E+00**	3.61E-01	1.45E-01	1.45E-02	5.27E-02	5.27E-03	2.69E-04	2.69E-05
Zinc	2.73E-01	1.36E-01	1.46E-02	7.31E-03	**2.58E+00**	2.86E-01	8.43E-01	9.33E-02

NA = NOAEL/LOAEL not available

TABLE 7-11

RESULTS OF FOOD CHAIN MODELING
AQUATIC RECEPTORS
MAXIMUM CONCENTRATIONS
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Ecological Contaminant of Potential Concern	Raccoon		Heron		Mummichog		Red Drum		Eagle	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Semivolatile Organic Compounds										
Anthracene	2.39E-02	1.19E-02	1.00E-02	1.00E-03	1.49E-01	1.49E-02	9.69E-02	9.69E-03	1.91E-03	1.91E-04
Benzo(a)anthracene	4.83E-02	4.83E-03	1.57E-02	1.57E-03	2.32E-01	2.32E-02	1.51E-01	1.51E-02	2.98E-03	2.98E-04
Benzo(a)pyrene	4.83E-02	4.83E-03	1.57E-02	1.57E-03	2.32E-01	2.32E-02	1.51E-01	1.51E-02	2.98E-03	2.98E-04
Benzo(b)fluoranthene	3.99E-02	3.99E-03	1.29E-02	1.29E-03	1.91E-01	1.91E-02	1.25E-01	1.25E-02	2.46E-03	2.46E-04
Carbazole	5.55E-02	2.77E-02	2.56E-02	2.56E-03	1.10E-01	1.10E-02	2.22E-01	2.22E-02	4.89E-03	4.89E-04
Chrysene	7.65E-02	7.65E-03	2.48E-02	2.48E-03	3.67E-01	3.67E-02	2.39E-01	2.39E-02	4.72E-03	4.72E-04
Dibenzofuran	4.01E-04	1.92E-04	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	1.41E-01	1.41E-02	4.57E-02	4.57E-03	6.77E-01	6.77E-02	4.41E-01	4.41E-02	8.70E-03	8.70E-04
Indeno(1,2,3-cd)pyrene	2.66E-02	2.66E-03	8.61E-03	8.61E-04	1.28E-01	1.28E-02	8.31E-02	8.31E-03	1.64E-03	1.64E-04
Phenanthrene	2.34E-01	1.17E-01	1.08E-01	1.08E-02	4.64E-01	4.64E-02	9.34E-01	9.34E-02	2.06E-02	2.06E-03
Pyrene	1.09E-01	1.09E-02	3.52E-02	3.52E-03	5.22E-01	5.22E-02	3.40E-01	3.40E-02	6.71E-03	6.71E-04
PESTICIDES/PCBs										
4,4'-DDD	1.42E-02	2.83E-03	**1.30E+01**	**1.30E+00**	NA	NA	NA	NA	**2.49E+00**	2.49E-01
4,4'-DDE	2.12E-03	1.02E-03	**5.57E+01**	**5.57E+00**	NA	NA	NA	NA	**1.06E+01**	**1.06E+00**
4,4'-DDT	8.84E-03	1.77E-03	**9.12E+00**	9.12E-01	NA	NA	NA	NA	**1.74E+00**	1.74E-01
Alpha-Chlordane	3.56E-03	1.78E-03	2.81E-02	5.61E-03	NA	NA	NA	NA	5.35E-03	1.07E-03
Aroclor-1254	8.45E-01	8.45E-02	**1.16E+00**	1.16E-01	NA	NA	NA	NA	2.20E-01	2.20E-02
Aroclor-1260	2.37E-01	2.37E-02	3.24E-01	3.24E-02	NA	NA	NA	NA	6.17E-02	6.17E-03
Gamma-Chlordane	1.67E-03	8.36E-04	1.31E-02	2.61E-03	NA	NA	NA	NA	2.49E-03	4.98E-04
INORGANICS										
Aluminum	**1.95E+03**	**1.95E+02**	**1.22E+02**	**1.22E+01**	NA	NA	NA	NA	**2.32E+01**	**2.32E+00**
Arsenic	**1.99E+01**	**1.99E+00**	**1.73E+00**	6.94E-01	**1.95E+00**	1.62E-01	**3.92E+00**	3.26E-01	3.30E-01	1.32E-01
Barium	**1.34E+00**	1.34E-01	**1.16E+00**	5.80E-01	NA	NA	NA	NA	2.22E-01	1.11E-01
Beryllium	2.68E-01	2.68E-02	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	7.09E-01	7.09E-02	**2.52E+00**	2.52E-01	NA	NA	NA	NA	4.80E-01	4.80E-02
Copper	5.07E-01	3.92E-01	4.49E-01	3.42E-01	NA	NA	NA	NA	8.55E-02	6.52E-02
Cyanide	1.31E-03	1.31E-04	7.10E-02	7.10E-03	NA	NA	NA	NA	1.35E-02	1.35E-03
Iron	**7.09E+01**	**7.09E+00**	**1.26E+02**	**1.26E+01**	NA	NA	NA	NA	**2.40E+01**	**2.40E+00**
Lead	**1.66E+00**	1.66E-01	**4.18E+01**	**4.18E+00**	NA	NA	NA	NA	7.96E+00	7.96E-01
Manganese	2.95E-01	9.14E-02	9.44E-02	9.44E-03	NA	NA	NA	NA	1.80E-02	1.80E-03
Mercury	**2.95E+00**	**1.77E+00**	**2.46E+01**	**2.46E+00**	**2.54E+00**	2.16E-02	**5.11E+00**	4.35E-02	**4.69E+00**	4.69E-01
Selenium	6.96E-01	4.22E-01	**1.24E+00**	6.18E-01	NA	NA	NA	NA	2.36E-01	1.18E-01
Thallium	**1.06E+01**	**1.06E+00**	5.93E-01	5.93E-02	NA	NA	NA	NA	1.13E-01	1.13E-02
Vanadium	**3.84E+01**	**3.84E+00**	**2.51E+00**	2.51E-01	NA	NA	NA	NA	4.79E-01	4.79E-02
Zinc	1.26E-01	6.29E-02	**4.93E+00**	5.46E-01	NA	NA	NA	NA	9.40E-01	1.04E-01

NA = NOAEL/LOAEL not available

TABLE 7-13

RESULTS OF FOOD CHAIN MODELING
AQUATIC RECEPTORS
MAXIMUM CONCENTRATIONS - FILTERED SURFACE WATER
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Ecological Contaminant of Potential Concern	Raccoon		Heron		Red Drum		Eagle	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
INORGANICS								
Aluminum	**3.19E+02**	**3.19E+01**	1.30E-01	1.30E-02	NA	NA	6.75E-02	6.75E-03
Antimony	ND	ND	NA	NA	ND	ND	NA	NA
Arsenic	**3.54E+00**	3.54E-01	8.35E-03	3.34E-03	1.07E-01	8.89E-03	5.12E-03	2.05E-03
Barium	2.58E-01	2.58E-02	1.01E-02	5.05E-03	NA	NA	6.44E-03	3.21E-03
Beryllium	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND	ND	ND	ND	ND
Copper	8.24E-02	6.37E-02	3.50E-04	2.67E-04	NA	NA	1.56E-04	1.19E-04
Iron	**1.71E+01**	**1.71E+00**	**2.71E+00**	2.71E-01	NA	NA	**1.78E+00**	1.78E-01
Lead	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	1.76E-01	5.45E-02	1.07E-02	1.07E-03	NA	NA	7.15E-03	7.15E-04
Mercury	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ND	ND	NA	NA	ND	ND	NA	NA
Thallium	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	**6.17E+00**	6.17E-01	8.49E-04	8.49E-05	NA	NA	1.16E-06	1.16E-07
Zinc	2.50E-02	1.25E-02	5.02E-02	5.55E-03	NA	NA	3.30E-02	3.65E-03

NA = NOAEL/LOAEL not available

ND = Not Detected

TABLE 7-13

RESULTS OF FOOD CHAIN MODELING
AQUATIC RECEPTORS
MEAN CONCENTRATIONS
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Ecological Contaminant of Potential Concern	Raccoon		Heron		Mummichog		Red Drum		Eagle	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Semivolatile Organic Compounds										
Anthracene	1.71E-03	8.53E-04	1.60E-03	1.60E-04	1.06E-02	1.06E-03	6.93E-03	6.93E-04	1.37E-04	1.37E-05
Benzo(a)anthracene	5.67E-03	5.67E-04	4.09E-03	4.09E-04	2.72E-02	2.72E-03	1.77E-02	1.77E-03	3.50E-04	3.50E-05
Benzo(a)pyrene	4.27E-03	4.27E-04	3.08E-03	3.08E-04	2.05E-02	2.05E-03	1.34E-02	1.34E-03	2.64E-04	2.64E-05
Benzo(b)fluoranthene	2.94E-03	2.94E-04	2.12E-03	2.12E-04	1.41E-02	1.41E-03	9.18E-03	9.18E-04	1.81E-04	1.81E-05
Carbazole	3.98E-02	1.99E-02	4.10E-02	4.10E-03	7.91E-02	7.91E-03	1.59E-01	1.59E-02	3.51E-03	3.51E-04
Chrysene	5.97E-03	5.97E-04	4.31E-03	4.31E-04	2.87E-02	2.87E-03	1.87E-02	1.87E-03	3.69E-04	3.69E-05
Dibenzofuran	8.25E-04	3.96E-04	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	9.05E-03	9.05E-04	6.53E-03	6.53E-04	4.35E-02	4.35E-03	2.83E-02	2.83E-03	5.59E-04	5.59E-05
Indeno(1,2,3-cd)pyrene	3.14E-03	3.14E-04	2.26E-03	2.26E-04	1.50E-02	1.50E-03	9.80E-03	9.80E-04	1.93E-04	1.93E-05
Phenanthrene	1.49E-02	7.44E-03	1.53E-02	1.53E-03	2.96E-02	2.96E-03	5.95E-02	5.95E-03	1.31E-03	1.31E-04
Pyrene	9.05E-03	9.05E-04	6.53E-03	6.53E-04	4.34E-02	4.34E-03	2.83E-02	2.83E-03	5.58E-04	5.58E-05
PESTICIDES/PCBs										
4,4'-DDD	2.02E-03	4.04E-04	**4.15E+00**	4.15E-01	NA	NA	NA	NA	3.54E-01	3.54E-02
4,4'-DDE	1.37E-03	6.61E-04	**8.05E+01**	**8.05E+00**	NA	NA	NA	NA	**6.88E+00**	6.88E-01
4,4'-DDT	7.56E-03	1.51E-03	**1.74E+01**	**1.74E+00**	NA	NA	NA	NA	**1.49E+00**	1.49E-01
Alpha-Chlordane	1.85E-02	9.26E-03	3.26E-01	6.51E-02	NA	NA	NA	NA	2.78E-02	5.57E-03
Aroclor-1254	9.61E-02	9.61E-03	2.93E-01	2.93E-02	NA	NA	NA	NA	2.51E-02	2.51E-03
Aroclor-1260	4.94E-02	4.94E-03	1.51E-01	1.51E-02	NA	NA	NA	NA	1.29E-02	1.29E-03
Gamma-Chlordane	8.70E-03	4.35E-03	1.52E-01	3.03E-02	NA	NA	NA	NA	1.30E-02	2.59E-03
INORGANICS										
Aluminum	**8.56E+02**	**8.56E+01**	**1.19E+02**	**1.19E+01**	NA	NA	NA	NA	**1.02E+01**	**1.02E+00**
Arsenic	**6.46E+00**	6.46E-01	**1.26E+00**	5.03E-01	6.33E-01	5.26E-02	**1.27E+00**	1.06E-01	1.07E-01	4.30E-02
Barium	4.28E-01	4.28E-02	8.31E-01	4.14E-01	NA	NA	NA	NA	7.10E-02	3.54E-02
Beryllium	9.17E-02	9.17E-03	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	2.57E-01	2.57E-02	**2.04E+00**	2.04E-01	NA	NA	NA	NA	1.74E-01	1.74E-02
Copper	1.66E-01	1.28E-01	3.27E-01	2.49E-01	NA	NA	NA	NA	2.80E-02	2.13E-02
Cyanide	8.80E-04	8.80E-05	1.06E-01	1.06E-02	NA	NA	NA	NA	9.10E-03	9.10E-04
Iron	**3.23E+01**	**3.23E+00**	**1.28E+02**	**1.28E+01**	NA	NA	NA	NA	**1.09E+01**	**1.09E+00**
Lead	4.73E-01	4.73E-02	**2.65E+01**	**2.65E+00**	NA	NA	NA	NA	**2.27E+00**	2.27E-01
Manganese	1.00E-01	3.11E-02	7.16E-02	7.16E-03	NA	NA	NA	NA	6.12E-03	6.12E-04
Mercury	4.72E-01	2.83E-01	**8.76E+00**	8.76E-01	4.06E-01	3.45E-03	8.17E-01	6.95E-03	7.49E-01	7.49E-02
Selenium	2.16E-01	1.31E-01	8.54E-01	4.27E-01	NA	NA	NA	NA	7.30E-02	3.65E-02
Thallium	**3.67E+00**	3.67E-01	4.57E-01	4.57E-02	NA	NA	NA	NA	3.91E-02	3.91E-03
Vanadium	**1.75E+01**	**1.75E+00**	**2.56E+00**	2.56E-01	NA	NA	NA	NA	2.19E-01	2.19E-02
Zinc	3.43E-02	1.71E-02	**2.99E+00**	3.31E-01	NA	NA	NA	NA	2.56E-01	2.83E-02

NA = NOAEL/LOAEL not available

TABLE 7-14

RESULTS OF FOOD CHAIN MODELING
AQUATIC RECEPTORS
MEAN CONCENTRATIONS - FILTERED SURFACE WATER
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Ecological Contaminant of Potential Concern	Raccoon		Heron		Red Drum		Eagle	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
INORGANICS								
Aluminum	**1.37E+02**	**1.37E+01**	1.45E-02	1.45E-03	NA	NA	8.53E-03	8.53E-04
Antimony	ND	ND	NA	NA	ND	ND	NA	NA
Arsenic	1.08E+00	1.08E-01	1.07E-03	4.28E-04	3.36E-02	2.79E-03	6.86E-04	2.75E-04
Barium	1.03E-01	1.03E-02	7.89E-03	3.94E-03	NA	NA	5.23E-03	2.61E-03
Beryllium	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND	ND	ND	ND	ND
Copper	2.72E-02	2.10E-02	1.78E-04	1.36E-04	NA	NA	1.14E-04	8.68E-05
Iron	**5.62E+00**	5.62E-01	2.24E-01	2.24E-02	NA	NA	1.48E-01	1.48E-02
Lead	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	4.23E-02	1.31E-02	2.19E-03	2.19E-04	NA	NA	1.46E-03	1.46E-04
Mercury	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ND	ND	NA	NA	ND	ND	NA	NA
Thallium	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	**2.80E+00**	2.80E-01	4.59E-05	4.59E-06	NA	NA	9.72E-08	9.72E-09
Zinc	8.29E-03	4.15E-03	2.89E-02	3.20E-03	NA	NA	1.93E-02	2.13E-03

NA = NOAEL/LOAEL not available
ND = Not Detected

TABLE 7-15

RESULTS OF FOOD CHAIN MODELING USING TISSUE DATA
MAXIMUM CONCENTRATIONS
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Ecological Contaminant of Potential Concern	Raccoon		Eagle (fish muscle)		Eagle (fish liver)	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
SEMIVOLATILE ORGANIC COMPOUNDS						
2-Methylnaphthalene	2.72E-04	2.72E-05	3.84E-05	3.84E-06	1.06E-03	1.06E-04
Acenaphthylene	3.74E-04	1.87E-04	2.28E-05	2.28E-06	3.96E-05	3.96E-06
Acenaphthene	2.69E-04	1.35E-04	1.92E-05	1.92E-06	2.40E-04	2.40E-05
Fluorene	4.04E-05	2.02E-05	1.56E-05	1.56E-06	1.44E-04	1.44E-05
Phenanthrene	3.29E-04	1.64E-04	2.28E-05	2.28E-06	5.88E-04	5.88E-05
Anthracene	2.39E-04	1.20E-04	1.92E-05	1.92E-06	7.20E-05	7.20E-06
Fluoranthene	2.33E-04	2.33E-05	7.44E-06	7.44E-07	9.72E-04	9.72E-05
Pyrene	1.21E-03	1.21E-04	3.60E-05	3.60E-06	6.24E-03	6.24E-04
Benzo(a)anthracene	ND	ND	ND	ND	6.48E-05	6.48E-06
Chrysene	6.22E-04	6.22E-05	3.84E-05	3.84E-06	7.80E-05	7.80E-06
Benzo(b)fluoranthene	1.34E-03	1.34E-04	6.96E-05	6.96E-06	1.68E-04	1.68E-05
Benzo(k)fluoranthene	9.14E-04	9.14E-05	4.56E-05	4.56E-06	1.20E-04	1.20E-05
Benzo(a)pyrene	7.97E-04	7.97E-05	3.24E-05	3.24E-06	6.24E-05	6.24E-06
Indeno(1,2,3-cd)pyrene	3.89E-04	3.89E-05	1.80E-05	1.80E-06	ND	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	7.19E-04	7.19E-05	3.24E-05	3.24E-06	3.84E-04	3.84E-05
PESTICIDE/PCBs						
Aroclor-1254	1.69E-01	1.69E-02	4.87E-02	4.87E-03	5.93E-01	5.93E-02
Aroclor-1260	ND	ND	1.67E-03	1.67E-04	ND	ND
4,4'-DDD	5.10E-04	1.02E-04	4.71E-01	4.71E-02	**1.50E+01**	**1.50E+00**
4,4'-DDE	2.14E-04	1.03E-04	**2.40E+00**	2.40E-01	**3.21E+01**	**3.21E+00**
4,4'-DDT	ND	ND	4.29E-02	4.29E-03	ND	ND
cis-Chlordane	5.07E-05	2.54E-05	1.12E-04	2.24E-05	8.97E-04	1.79E-04
INORGANIC COMPOUNDS						
Mercury	1.43E-01	8.55E-02	**1.29E+00**	1.29E-01	**2.06E+00**	2.06E-01

ND = For raccoon, not detected in crab, clam, or oyster tissue. For eagle, not detected in mullet or flounder tissue.

TABLE 7-16

RESULTS OF FOOD CHAIN MODELING USING TISSUE DATA
MEAN CONCENTRATIONS
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Ecological Contaminant of Potential Concern	Raccoon		Eagle (fish muscle)		Eagle (fish liver)	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
SEMIVOLATILE ORGANIC COMPOUNDS						
2-Methylnaphthalene	2.14E-04	2.14E-05	1.22E-05	1.22E-06	1.99E-04	1.99E-05
Acenaphthylene	1.79E-04	8.97E-05	1.62E-05	1.62E-06	2.88E-05	2.88E-06
Acenaphthene	2.39E-05	1.20E-05	6.90E-06	6.90E-07	4.20E-05	4.20E-06
Fluorene	2.84E-05	1.42E-05	5.31E-06	5.31E-07	5.73E-05	5.73E-06
Phenanthrene	2.69E-04	1.35E-04	7.92E-06	7.92E-07	1.66E-04	1.66E-05
Anthracene	2.09E-05	1.05E-05	6.52E-06	6.52E-07	3.15E-05	3.15E-06
Fluoranthene	1.01E-03	1.01E-04	3.03E-06	3.03E-07	1.01E-04	1.01E-05
Pyrene	5.25E-04	5.25E-05	2.93E-06	2.93E-07	3.41E-04	3.41E-05
Benzo(a)anthracene	7.00E-04	7.00E-05	3.33E-05	3.33E-06	4.50E-05	4.50E-06
Chrysene	2.92E-04	2.92E-05	2.22E-05	2.22E-06	3.87E-05	3.87E-06
Benzo(b)fluoranthene	2.92E-04	2.92E-05	5.10E-05	5.10E-06	6.33E-05	6.33E-06
Benzo(k)fluoranthene	1.94E-04	1.94E-05	3.45E-05	3.45E-06	4.21E-05	4.21E-06
Benzo(a)pyrene	5.25E-04	5.25E-05	3.09E-05	3.09E-06	4.38E-05	4.38E-06
Indeno(1,2,3-cd)pyrene	2.92E-04	2.92E-05	1.53E-05	1.53E-06	2.43E-05	2.43E-06
Dibenzo(a,h)anthracene	3.59E-04	1.79E-04	2.25E-05	2.25E-06	3.39E-05	3.39E-06
Benzo(g,h,i)perylene	5.44E-04	5.44E-05	2.31E-05	2.31E-06	6.48E-05	6.48E-06
PESTICIDE/PCBs						
Aroclor-1254	1.40E-01	1.40E-02	1.50E-02	1.50E-03	1.01E-01	1.01E-02
Aroclor-1260	ND	ND	1.50E-03	1.50E-04	ND	ND
4,4'-DDD	1.29E-03	2.58E-04	1.32E-01	1.32E-02	**1.60E+00**	1.60E-01
4,4'-DDE	1.26E-04	6.09E-05	5.39E-01	5.39E-02	**4.08E+00**	4.08E-01
4,4'-DDT	ND	ND	3.17E-02	3.17E-03	ND	ND
cis-Chlordane	1.06E-05	5.28E-06	2.86E-05	5.72E-06	3.25E-04	6.50E-05
INORGANIC COMPOUNDS						
Mercury	1.43E-01	8.55E-02	5.69E-01	5.69E-02	**1.49E+00**	1.49E-01

ND = Not Detected

TABLE 7-17

COMPARISON OF ECOLOGICAL COPCs IN SEDIMENT
TO VARIOUS GUIDELINES
SITE 3 – CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 2

COPC	Maximum	Mean	Region 4 ESV	ER-M	PEL	Other
VOLATILE ORGANIC COMPOUNDS (µg/kg)						
2-Butanone	61	13.7	NA	NA	NA	NA
Acetone	170	75.1	NA	NA	NA	NA
Carbon Disulfide	40	11.7	NA	NA	NA	NA
Chloroform	1	9.2	NA	NA	NA	NA
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)						
Anthracene	770	55.0	46.9	1100	245	85.3[a]
Benzo(a)anthracene	1200	104.7	74.8	1600	693	261[a]
Benzo(a)pyrene	1200	106.1	88.8	1600	763	430[a]
Benzo(b)fluoranthene	990	73.0	NA	NA	NA	3,200[a]
Carbazole	570	409.2	NA	NA	NA	NA
Chrysene	1900	148.3	108	2800	846	384[a]
Dibenzofuran	190	391.1	NA	NA	NA	540[a]
Fluoranthene	3500	224.8	113	5100	1494	8,680[b]
Indeno(1,2,3-cd)pyrene	660	77.8	NA	NA	NA	600[a]
Phenanthrene	2400	152.9	86.7	1500	544	2,520[b]
Pyrene	2700	224.6	153	2600	1398	665[a]
PESTICIDES/PCBs (µg/kg)						
4,4'-DDD	290	41.4	1.22	NA	7.81	16[a]
4,4'-DDE	45	29.2	2.07	27	374	2.2[a]
4,4'-DDT	34	29.1	1.19	46.1[2]	4.77	1.58[a]
Aroclor-1254	250	28.4	21.6[d]	180	189	22.7[a]
Aroclor-1260	70	14.6	21.6[a]	180	189	22.7[a]
Alpha-Chlordane	28	145.8	0.5[a]	NA	NA	NA
Gamma-Chlordane	28	145.8	0.5[a]	NA	NA	NA
METALS AND INORGANIC COMPOUNDS (mg/kg)						
Aluminum	29700	13060.5	NA	NA	NA	NA
Arsenic	19.8	6.4	7.24	70	41.6	8.2[a]
Barium	53.8	17.2	NA	NA	NA	NA
Beryllium	1.4	0.5	NA	NA	NA	NA
Cobalt	5.6	2.0	NA	NA	NA	NA
Copper	46.9	15.3	18.7	270	108	34[a]
Cyanide	0.71	0.5	NA	NA	NA	NA
Iron	28000	12744.8	NA	NA	NA	NA
Lead	105	29.9	30.2	218	112	46.7[a]

TABLE 7-17

COMPARISON OF ECOLOGICAL COPCs IN SEDIMENT
TO VARIOUS GUIDELINES
SITE 3 – CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

COPC	Maximum	Mean	Region 4 ESV	ER-M	PEL	Other
Manganese	205	69.7	NA	NA	NA	NA
Mercury	0.35	0.06	0.13	0.71	0.7	0.15[a]
Selenium	1.1	0.3	NA	NA	NA	NA
Thallium	0.62	0.2	NA	NA	NA	NA
Vanadium	63.7	29.1	NA	NA	NA	NA
Zinc	159	43.3	124	410	271	150[a]

NA Not Available
ER-M Effects Range Medium (Long et al., 1995)
PEL Probable Effects Level (FDEP, 1994)
a EPA Region 3 BTAG Ecological Screening Value (EPA, 1995c)
b Sediment Quality Advisory Level based on site specific organic carbon content (EPA, 1997c)
c ER-M value for total DDT
d ESV for total PCBs
e ESV for total chlordane

TABLE 7-18

COMPARISON OF SURFACE SOIL CHEMICALS OF POTENTIAL CONCERN (COPCs)
TO OTHER GUIDELINES – SITE 3
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 2

COPC	Maximum	Mean	ORNL Earthworms/ microorganisms	ORNL Soil Phytotoxicity	BTAG Region III Fauna	BTAG Region III Flora	Beyer (1990) "A" Value	Beyer (1990) "B" Value	Dutch (1994) Target	Dutch (1994) Intervention
VOLATILE ORGANIC COMPOUNDS (µg/kg)										
2-Butanone	360	25.5	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	240	169.2	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	2	2.8	NA	NA	300	300	NA	NA	NA	NA
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)										
2-Methylnapthanlene	300	187	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	120	175	NA	NA	100	100	NA	NA	NA	5000
Acenaphthylene	1800	350.4	NA	NA	100	100	NA	NA	NA	NA
Anthracene	340	33.2	NA	NA	100	100	100	10000	NA	NA
Benzo(a)anthracene	3000	224.9	NA	NA	100	100	NA	NA	NA	NA
Benzo(a)pyrene	4000	289.5	NA	NA	100	NA	100	1000	NA	NA
Benzo(b)fluoranthene	3400	247	NA	NA	100	100	NA	NA	NA	NA
Benzo(g,h,i)perylene	3500	198.2	NA	NA	100	100	NA	NA	NA	NA
Benzo(k)fluoranthene	1300	96.7	NA	NA	100	100	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	2300	319.7	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	670	194.5	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	2900	230.4	NA	NA	100	100	NA	NA	NA	NA
Dibenzofuran	340	189.7	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	5100	413.7	NA	NA	100	100	100	10000	NA	NA
Indeno(1,2,3-cd)pyrene	3600	193.4	NA	NA	100	100	NA	NA	NA	NA
Phenanthrene	1200	119.0	NA	NA	100	100	100	5000	NA	NA
Pyrene	4500	359.9	NA	NA	100	100	100	10000	NA	NA

TABLE 7-18

COMPARISON OF SURFACE SOIL CHEMICALS OF POTENTIAL CONCERN (COPCs)
TO OTHER GUIDELINES – SITE 3
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 2 OF 2

COPC	Maximum	Mean	ORNL Earthworms/ microorganisms	ORNL Soil Phytotoxicity	BTAG Region III Fauna	BTAG Region III Flora	Beyer (1990) "A" Value	Beyer (1990) "B" Value	Dutch (1994) Target	Dutch (1994) Intervention
PESTICIDES/PCBs (µg/kg)										
4,4'-DDE	4.1	11.6	NA	NA	100	100	NA	NA	2.5	4000
4,4'-DDT	4.5	11.7	NA	NA	100	100	NA	NA	2.5	4000
Aroclor-1254	56	7.7	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1260	100	13.6	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-Chlordane	96	95.9	NA	NA	100	100	NA	NA	NA	NA
Gamma-Chlordane	53	93.3	NA	NA	100	100	NA	NA	NA	NA
METALS AND INORGANIC COMPOUNDS (mg/kg)										
Aluminum	10800	5745.3	600	50	NA	1	NA	NA	NA	NA
Arsenic	11.8	1.7	60	10	NA	328	20	30	29	55
Iron	7370	4788.1	200	NA	12	3,260	NA	NA	NA	NA
Lead	264	31.0	500	50	0.01	2	50	150	85	530
Mercury	0.43	0.06	0.1	0.3	0.058	0.058	0.5	2.0	0.3	10
Vanadium	21.4	10.5	20	2.0	58	0.5	NA	NA	NA	NA
Zinc	205	27.3	100	50	NA	10	200	500	140	720

NA – Not Available

TABLE 7-18

COMPARISON OF SURFACE SOIL CHEMICALS OF POTENTIAL CONCERN (COPCs)
TO OTHER GUIDELINES – SITE 3
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 1 OF 2

COPC	Maximum	Mean	ORNL Earthworms/ microorganisms	ORNL Soil Phytotoxicity	BTAG Region III Fauna	BTAG Region III Flora	Beyer (1990) "A" Value	Beyer (1990) "B" Value	Dutch (1994) Target	Dutch (1994) Intervention
VOLATILE ORGANIC COMPOUNDS (µg/kg)										
2-Butanone	360	25.5	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	240	169.2	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	2	2.8	NA	NA	300	300	NA	NA	NA	NA
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)										
2-Methylnapthanlene	300	187	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	120	175	NA	NA	100	100	NA	NA	NA	5000
Acenaphthylene	1800	350.4	NA	NA	100	100	NA	NA	NA	NA
Anthracene	340	33.2	NA	NA	100	100	100	10000	NA	NA
Benzo(a)anthracene	3000	224.9	NA	NA	100	100	NA	NA	NA	NA
Benzo(a)pyrene	4000	289.5	NA	NA	100	NA	100	1000	NA	NA
Benzo(b)fluoranthene	3400	247	NA	NA	100	100	NA	NA	NA	NA
Benzo(g,h,i)perylene	3500	198.2	NA	NA	100	100	NA	NA	NA	NA
Benzo(k)fluoranthene	1300	96.7	NA	NA	100	100	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	2300	319.7	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	670	194.5	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	2900	230.4	NA	NA	100	100	NA	NA	NA	NA
Dibenzofuran	340	189.7	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	5100	413.7	NA	NA	100	100	100	10000	NA	NA
Indeno(1,2,3-cd)pyrene	3600	193.4	NA	NA	100	100	NA	NA	NA	NA
Phenanthrene	1200	119.0	NA	NA	100	100	100	5000	NA	NA
Pyrene	4500	359.9	NA	NA	100	100	100	10000	NA	NA

TABLE 7-18

COMPARISON OF SURFACE SOIL CHEMICALS OF POTENTIAL CONCERN (COPCs)
TO OTHER GUIDELINES – SITE 3
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 2 OF 2

COPC	Maximum	Mean	ORNL Earthworms/ microorganisms	ORNL Soil Phytotoxicity	BTAG Region III Fauna	BTAG Region III Flora	Beyer (1990) "A" Value	Beyer (1990) "B" Value	Dutch (1994) Target	Dutch (1994) Intervention
PESTICIDES/PCBs (µg/kg)										
4,4'-DDE	4.1	11.6	NA	NA	100	100	NA	NA	2.5	4000
4,4'-DDT	4.5	11.7	NA	NA	100	100	NA	NA	2.5	4000
Aroclor-1254	56	7.7	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1260	100	13.6	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-Chlordane	96	95.9	NA	NA	100	100	NA	NA	NA	NA
Gamma-Chlordane	53	93.3	NA	NA	100	100	NA	NA	NA	NA
METALS AND INORGANIC COMPOUNDS (mg/kg)										
Aluminum	10800	5745.3	600	50	NA	1	NA	NA	NA	NA
Arsenic	11.8	1.7	60	10	NA	328	20	30	29	55
Iron	7370	4788.1	200	NA	12	3,260	NA	NA	NA	NA
Lead	264	31.0	500	50	0.01	2	50	150	85	530
Mercury	0.43	0.06	0.1	0.3	0.058	0.058	0.5	2.0	0.3	10
Vanadium	21.4	10.5	20	2.0	58	0.5	NA	NA	NA	NA
Zinc	205	27.3	100	50	NA	10	200	500	140	720

NA – Not Available

Appendix D.2
Post-Interim Remedy ERA Supporting Tables

TABLE 20

SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN MARSH-SIDE SEDIMENT SAMPLES
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Analyte	Frequency of Detection	Range of Detected Values	Location of Maximum Concentration	Range of Detection Limits in Non-Detect Samples	Ecological Screening Value	Maximum Hazard Quotient[1]	COPC (Yes/No)[2]
PAHs (µg/kg)							
Acenaphthene	1/5	28	PAI-03-SD-41-01-D	26 - 70	6.71	4.2	Yes
Anthracene	2/5	14 - 78	PAI-03-SD-41-01-D	26 - 70	46.9	1.7	Yes
Benzo(a)anthracene	5/5	12 - 300	PAI-03-SD-41-01-D	-	74.8	4.0	Yes
Benzo(a)pyrene	3/5	11 - 170	PAI-03-SD-41-01-D	56 - 70	88.8	1.9	Yes
Benzo(b)fluoranthene	5/5	13 - 230	PAI-03-SD-41-01-D	-	NA	NA	Yes
Benzo(g,h,i)perylene	3/5	12 - 71	PAI-03-SD-41-01-D	56 - 70	NA	NA	Yes
Benzo(k)fluoranthene	3/5	7 - 82	PAI-03-SD-41-01-D	56 - 70	NA	NA	Yes
Chrysene	3/5	12 - 190	PAI-03-SD-41-01-D	56 - 70	108	1.8	Yes
Dibenzo(a,h)anthracene	2/5	12 - 26	PAI-03-SD-41-01-D	28 - 70	6.22	4.2	Yes
Fluoranthene	5/5	34 - 470	PAI-03-SD-41-01-D	-	113	4.2	Yes
Fluorene	2/5	8 - 37	PAI-03-SD-41-01-D	26 - 70	21.2	1.7	Yes
Indeno(1,2,3-cd)pyrene	3/5	18 - 120	PAI-03-SD-41-01-D	28 - 70	NA	NA	Yes
Phenanthrene	3/5	7 - 320	PAI-03-SD-41-01-D	56 - 70	86.7	3.7	Yes
Pyrene	5/5	12 - 330	PAI-03-SD-41-01-D	-	153	2.2	Yes
Total PAHs[3]	5/5	216 - 1991	PAI-03-SD-41-01-D	-	1684	1.2	Yes
Pesticides (µg/kg)							
4,4'-DDD	2/5	1.4 - 3.8	PAI-03-SD-41-01	7.0-12	1.22	3.1	Yes
4,4'-DDE	5/5	1.4 - 2.9	PAI-03-SD-43-01	-	2.07	1.4	Yes
4,4'-DDT	2/5	1.5 - 12.0	PAI-03-SD-41-01	7.0-12	1.19	10.1	Yes
Total DDT[4]	5/5	4.4 - 17.6	PAI-03-SD-41-01	-	1.58	11.1	Yes
Alpha-Chlordane	1/5	6.6	PAI-03-SD-42-01	2.4-6.0	0.5	13.2	Yes
Inorganics (mg/kg)							
Arsenic	5/5	1.8 - 13.6	PAI-03-SD-44-01	-	7.24	1.9	Yes
Copper	5/5	3.5 - 27.1	PAI-03-SD-44-01	-	18.7	1.4	Yes
Lead	5/5	5.3 - 27.3	PAI-03-SD-44-01	-	30.2	0.9	No
Mercury	5/5	0.01 - 0.06	PAI-03-SD-43/44-01	-	0.13	0.5	No
Zinc	5/5	9.7 - 67.7	PAI-03-SD-44-01	-	124	0.5	No

Notes:
Marsh samples consisted of SD-41, SD-42, SD-43, SD-44, and SD-45. PCBs were not detected in these samples.
NA = USEPA Region 4 ecological screening value not available.

1 Hazard quotient (HQ) = maximum detected concentration ÷ ecological screening value.

2 An analyte was an ecological chemical of potential concern (COPC) if the maximum detected concentration was greater than the ecological screening value (i.e., HQ>1), or if an ecological screening value was not available.

3 Total PAH concentrations were calculated as the sum of concentrations of 2-methylnaphthalene, acenaphthene, acenapththylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene. One-half the detection limit was used to represent non-detected PAHs.

4 Total DDT = the sum of concentrations of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT isomers using one-half the detection limit to represent non-detected isomers.

TABLE 21

SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN POND-SIDE SEDIMENT AREA 1
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Analyte	Frequency of Detection	Range of Detected Values	Location of Maximum Concentration	Range of Detection Limits in Non-Detect Samples	Ecological Screening Value	Maximum Hazard Quotient[1]	COPC (Yes/No)[2]
PAHs (µg/kg)							
Benzo(a)anthracene	3/4	13 - 18	PAI-03-SD-47-01	28	74.8	0.2	No
Benzo(b)fluoranthene	3/4	10 - 15	PAI-03-SD-47-01	28	NA	NA	Yes
Chrysene	3/4	6 - 11	PAI-03-SD-47-01	28	108	0.1	No
Fluoranthene	3/4	25 - 28	PAI-03-SD-48-01	28	113	0.2	No
Phenanthrene	2/4	10 - 12	PAI-03-SD-49-01	28 - 50	86.7	0.1	No
Pyrene	3/4	14 - 17	PAI-03-SD-48-01	28	153	0.1	No
Total PAHs[3]	3/4	213 - 340	PAI-03-SD-47-01	-	1684	0.2	No
Inorganics (mg/kg)							
Arsenic	4/4	0.84 - 7.7	PAI-03-SD-47-01	-	7.24	1.1	Yes
Copper	4/4	1.1 - 10.2	PAI-03-SD-47-01	-	18.7	0.5	No
Lead	4/4	4.2 - 17.7	PAI-03-SD-47-01	-	30.2	0.6	No
Mercury	4/4	0.04 - 0.2	PAI-03-SD-48-01	-	0.13	1.5	Yes
Zinc	4/4	6.7 - 36.1	PAI-03-SD-47-01	-	124	0.3	No

Notes:
Area # 1 consisted of samples SD-46, SD-47, SD-48, and SD-49. These samples were not analyzed for pesticides or PCBs.
NA = USEPA Region 4 ecological screening value not available.

1 Hazard quotient (HQ) = maximum detected concentration ÷ ecological screening value.

2 An analyte was an ecological chemical of potential concern (COPC) if the maximum detected concentration was greater than the ecological screening value (i.e., HQ>1), or if an ecological screening value was not available.

3 Total PAH concentrations were calculated as the sum of concentrations of 2-methylnaphthalene, acenaphthene, acenapththylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene. One-half the detection limit was used to represent non-detected PAHs.

TABLE 22

SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN POND-SIDE SEDIMENT AREA 2
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Analyte	Frequency of Detection	Range of Detected Values	Location of Maximum Concentration	Ecological Screening Value	Maximum Hazard Quotient[1]	COPC (Yes/No)[2]
Inorganics (mg/kg)						
Arsenic	3/3	5.2 - 10.5	PAI-03-SD-50-01	7.24	1.5	Yes
Copper	3/3	7.7 - 22.5	PAI-03-SD-50-01	18.7	1.2	Yes
Lead	3/3	13.3 - 35.8	PAI-03-SD-50-01	30.2	1.2	Yes
Mercury	3/3	0.07 - 0.13	PAI-03-SD-52-01	0.13	1.0	No
Zinc	3/3	25.4 - 72.5	PAI-03-SD-50-01	124	0.6	No

Notes:
Area # 2 consisted of samples SD-50, SD-51, and SD-52. These samples were not analyzed for PAHs or pesticides, and PCBs were not detected.

1 Hazard quotient (HQ) = maximum detected concentration ÷ ecological screening value.
2 An analyte was an ecological chemical of potential concern (COPC) if the maximum detected concentration was greater than the ecological screening value (i.e., HQ>1), or if an ecological screening value was not available.

TABLE 23

SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN POND-SIDE SEDIMENT AREA 3
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Analyte	Frequency of Detection	Range of Detected Values	Location of Maximum Concentration	Range of Detection Limits in Non-Detect Samples	Ecological Screening Value	Maximum Hazard Quotient[1]	COPC (Yes/No)[2]
Pesticides (µg/kg)							
4,4'-DDD	1/3	2.7	PAI-03-SD-55-01	5.5 - 5.7	1.22	2.2	Yes
4,4'-DDE	2/3	1.2 -1.7	PAI-03-SD-55-01	5.7	2.07	0.8	No
4,4'-DDT	1/3	1.3	PAI-03-SD-55-01	5.5 - 5.7	1.19	1.1	Yes
Total DDT[3]	2/3	5.7 - 6.7	PAI-03-SD-54-01	-	1.58	4.2	Yes
Gamma-Chlordane	1/3	3.4	PAI-03-SD-54-01	2.9 - 3.2	0.5	6.8	Yes
Inorganics (mg/kg)							
Arsenic	3/3	2.1 -5.1	PAI-03-SD-55-01	-	7.24	0.7	No
Copper	3/3	3.2 -5.6	PAI-03-SD-55-01	-	18.7	0.3	No
Lead	3/3	9.9 -13.7	PAI-03-SD-55-01	-	30.2	0.5	No
Mercury	3/3	0.04 -0.09	PAI-03-SD-53-01	-	0.13	0.7	No
Zinc	3/3	16.5 -25.9	PAI-03-SD-55-01	-	124	0.2	No

Notes:
Area # 3 consisted of samples SD-53, SD-54, and SD-55. These samples were not analyzed for PAHs or PCBs.

1 Hazard quotient (HQ) = maximum detected concentration ÷ ecological screening value.
2 An analyte was an ecological chemical of potential concern (COPC) if the maximum detected concentration was greater than the ecological screening value (i.e., HQ>1), or if an ecological screening value was not available.
3 Total DDT = the sum of concentrations of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT isomers using one-half the detection limit to represent non-detected isomers.

TABLE 24

SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN POND-SIDE SEDIMENT AREA 4
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

2001 Sediment Samples

Analyte	Frequency of Detection	Range of Detected Values	Location of Maximum Concentration	Range of Detection Limits in Non-Detect Samples	Ecological Screening Value	Maximum Hazard Quotient[1]	COPC (Yes/No)[2]
Pesticides (µg/kg)							
4,4'-DDD	3/5	2.1 - 58	PAI-03-SD-59-01	7.8 - 19	1.22	47.5	Yes
4,4'-DDE	5/5	2.8 - 26	PAI-03-SD-59-01	0	2.07	12.6	Yes
4,4'-DDT	2/5	3.8	PAI-03-SD-59/60-01	4.3 - 19	1.19	3.2	Yes
Total DDT[3]	5/5	7.05 - 87.8	PAI-03-SD-59-01	-	1.58	55.6	Yes
Alpha-Chlordane	1/5	2.8	PAI-03-SD-59-01	2.2 - 9.6	0.5	5.6	Yes
Gamma-Chlordane	1/5	2	PAI-03-SD-57-01	2.2 - 9.6	0.5	4.0	Yes
Inorganics (mg/kg)							
Arsenic	5/5	1.6 -4.5	PAI-03-SD-58-01	-	7.24	0.6	No
Copper	5/5	4.2 -13.2	PAI-03-SD-60-01	-	18.7	0.7	No
Lead	5/5	14.6 -44.9	PAI-03-SD-60-01	-	30.2	1.5	Yes
Mercury	5/5	0.04 -0.16	PAI-03-SD-57/58-01	-	0.13	1.2	Yes
Zinc	5/5	38.1 -93.3	PAI-03-SD-60-01	-	124	0.8	No

Notes:
Samples collected in Area # 4 in 2001 consisted of SD-56, SD-57, SD-58, SD-59, and SD-60; these were not analyzed for PAHs or PCBs.

2003 Sediment Samples

Analyte	Frequency of Detection	Range of Detected Values	Location of Maximum Concentration	Range of Detection Limits in Non-Detect	Ecological Screening Value	Maximum Hazard Quotient[1]	COPC (Yes/No)[2]
Pesticides (µg/kg)							
4,4'-DDD	2/3	4.9 - 5.7	PAI-03-SD-61-01	12	1.22	4.7	Yes
4,4'-DDE	3/3	2.5 - 5.2	PAI-03-SD-61-01	-	2.07	2.5	Yes
Total DDT[3]	3/3	14.5 - 17.4	PAI-03-SD-61-01	-	1.58	11.0	Yes
Inorganics (mg/kg)							
Arsenic	3/3	5.3 - 6.4	PAI-03-SD-63-01	-	7.24	0.9	No
Lead	3/3	13 - 22	PAI-03-SD-63-01	-	30.2	0.7	No

Notes:
Samples collected in Area # 4 in 2003 consisted of SD-61, SD-62, and SD-63; these were not analyzed for PAHs or PCBs.

1 Hazard quotient (HQ) = maximum detected concentration ÷ ecological screening value.
2 An analyte was an ecological chemical of potential concern (COPC) if the maximum detected concentration was greater than the ecological screening value (i.e., HQ>1), or if an ecological screening value was not available.
3 Total DDT = the sum of concentrations of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT isomers using one-half the detection limit to represent non-detected isomers.

TABLE 25

SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SITE-WIDE SEDIMENT[1]
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Analyte	Frequency of Detection	Range of Detected Values	Location of Maximum Concentration	Range of Detection Limits in Non-Detect Samples	Ecological Screening Value	Maximum Hazard Quotient[2]	COPC (Yes/No)[3]
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	1/9	28	PAI-03-SD-41-01-D	26 - 70	6.71	4.2	Yes
Anthracene	2/9	14 - 78	PAI-03-SD-41-01-D	26 - 70	46.9	1.7	Yes
Benzo(a)anthracene	8/9	12 - 300	PAI-03-SD-41-01-D	28	74.8	4.0	Yes
Benzo(a)pyrene	3/9	11 - 170	PAI-03-SD-41-01-D	28 - 70	88.8	1.9	Yes
Benzo(b)fluoranthene	8/9	10 - 230	PAI-03-SD-41-01-D	28	NA	NA	Yes
Benzo(g,h,i)perylene	3/9	12 - 71	PAI-03-SD-41-01-D	28 - 70	NA	NA	Yes
Benzo(k)fluoranthene	3/9	7 - 82	PAI-03-SD-41-01-D	28 - 70	NA	NA	Yes
Chrysene	6/9	6 - 190	PAI-03-SD-41-01-D	28 - 70	108	1.8	Yes
Dibenzo(a,h)anthracene	2/9	12 - 26	PAI-03-SD-41-01-D	28 - 70	6.22	4.2	Yes
Fluoranthene	8/9	21 - 470	PAI-03-SD-41-01-D	28	113	4.2	Yes
Fluorene	2/9	8 - 37	PAI-03-SD-41-01-D	26 - 70	21.2	1.7	Yes
Indeno(1,2,3-cd)pyrene	3/9	18 - 120	PAI-03-SD-41-01-D	28 - 70	NA	NA	Yes
Phenanthrene	5/9	7 - 320	PAI-03-SD-41-01-D	28 - 70	86.7	3.7	Yes
Pyrene	8/9	12 - 330	PAI-03-SD-41-01-D	28	153	2.2	Yes
Total PAHs[4]	8/9	213-1991	PAI-03-SD-41-01-D	-	1684	1.2	Yes
Pesticides/PCBs (µg/kg)							
4,4'-DDD	8/16	1.4 - 58	PAI-03-SD-59-01	5.5 - 19	1.22	47.5	Yes
4,4'-DDE	15/16	1.2 - 26	PAI-03-SD-59-01	5.7	2.07	12.6	Yes
4,4'-DDT	5/16	1.1 - 12	PAI-03-SD-41-01	4.3 - 19	1.19	10.1	Yes
Total DDT[5]	15/16	4.4 - 87.8	PAI-03-SD-59-01	-	1.58	55.6	Yes
Alpha-Chlordane	2/13	2.8 - 6.6	PAI-03-SD-42-01	2.2 - 9.6	0.5	13.2	Yes
Gamma-Chlordane	2/13	2 - 3.4	PAI-03-SD-54-01	2.2 - 9.6	0.5	6.8	Yes
Inorganics (mg/kg)							
Arsenic	23/23	0.84 - 13.6	PAI-03-SD-44-01	-	7.24	1.9	Yes
Copper	20/20	1.1 - 27.1	PAI-03-SD-44-01	-	18.7	1.4	Yes
Lead	23/23	4.2 - 44.9	PAI-03-SD-60-01	-	30.2	1.5	Yes
Mercury	20/23	0.01 - 0.2	PAI-03-SD-48-01	0.19 - 0.2	0.13	1.5	Yes
Zinc	20/20	6.7 - 93.3	PAI-03-SD-58-01	-	124	0.8	No

Notes:
NA = USEPA Region 4 ecological screening value not available.

1 Site-wide data set consists of all samples collected in 2001 and 2003.
2 Hazard quotient (HQ) = maximum detected concentration ÷ ecological screening value.
3 An analyte was an ecological chemical of potential concern (COPC) if the maximum detected concentration was greater than the ecological screening value (i.e., HQ>1), or if an ecological screening value was not available.
4 Total PAH concentrations = the sum of concentrations of 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene. One-half the detection limit was used to represent non-detected PAHs.
5 Total DDT = the sum of concentrations of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT isomers using one-half the detection limit to represent non-detected isomers.

TABLE 26

DATA SUMMARY FOR ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SITE-WIDE SEDIMENT[1]
SITE 3 - CAUSEWAY LANDFILL
MCRD PARRIS ISLAND, SOUTH CAROLINA

Analyte	Frequency of Detection	Range of Detected Values	Location of Maximum Concentration	Range of Detection Limits in Non-Detect Samples	Ecological Screening Value (ESV)	Maximum Hazard Quotient[2]	Average Detected Conc.[3]	Average of all Conc.[4]	Number of Detects Exceeding ESV	Background/ Typical Facility Conc[5]	Retained as Final COPC in Sediment?
Semivolatile Organic Compounds (µg/kg)											
Acenaphthene	1/9	28	PAI-03-SD-41-01-D	26 - 70	6.71	4.2	28	22	1	NA	No[6]
Anthracene	2/9	14 - 78	PAI-03-SD-41-01-D	26 - 70	46.9	1.7	30	23	1	NA	No[6]
Benzo(a)anthracene	8/9	12 - 300	PAI-03-SD-41-01-D	28	74.8	4.0	45	42	1	NA	No[6]
Benzo(a)pyrene	3/9	11 - 170	PAI-03-SD-41-01-D	28 - 70	88.8	1.9	54	33	1	NA	No[6]
Benzo(b)fluoranthene	8/9	10 - 230	PAI-03-SD-41-01-D	28	NA	NA	36	34	NA	NA	No[6]
Benzo(g,h,i)perylene	3/9	12 - 71	PAI-03-SD-41-01-D	28 - 70	NA	NA	28	24	NA	NA	No[6]
Benzo(k)fluoranthene	3/9	7 - 82	PAI-03-SD-41-01-D	28 - 70	NA	NA	28	24	NA	NA	No[6]
Chrysene	6/9	6 - 190	PAI-03-SD-41-01-D	28 - 70	108	1.8	31	29	1	NA	No[6]
Dibenzo(a,h)anthracene	2/9	12 - 26	PAI-03-SD-41-01-D	28 - 70	6.22	4.2	19	21	2	NA	No[6]
Fluoranthene	8/9	21 - 470	PAI-03-SD-41-01-D	28	113	4.2	71	65	2	NA	No[6]
Fluorene	2/9	8 - 37	PAI-03-SD-41-01-D	26 - 70	21.2	1.7	17	20	1	NA	No[6]
Indeno(1,2,3-cd)pyrene	3/9	18 - 120	PAI-03-SD-41-01-D	28 - 70	NA	NA	44	29	NA	NA	No[6]
Phenanthrene	5/9	7 - 320	PAI-03-SD-41-01-D	28 - 70	86.7	3.7	53	41	1	NA	No[6]
Pyrene	8/9	12 - 330	PAI-03-SD-41-01-D	28	153	2.2	44	41	1	NA	No[6]
Total PAHs[7]	8/9	213-1991	PAI-03-SD-41-01-D	-	1684	1.2	440	-	1	NA	No[6]
Pesticides/PCBs (µg/kg)											
4,4'-DDD	8/16	1.4 - 58	PAI-03-SD-59-01	5.5 - 19	1.22	47.5	11.3	8.1	8	33.6	No[6]
4,4'-DDE	15/16	1.2 - 26	PAI-03-SD-59-01	5.7	2.07	12.6	4.8	4.7	9	31.6	No[6]
4,4'-DDT	5/16	1.1 - 12	PAI-03-SD-41-01	4.3 - 19	1.19	10.1	3.4	4.5	5	34.5	No[6]
Total DDT[8]	15/16	4.4 - 87.8	PAI-03-SD-59-01	-	1.58	55.6	17.3	-	15	99.8	No[6]
Alpha-Chlordane	2/13	2.8 - 6.6	PAI-03-SD-42-01	2.2 - 9.6	0.5	13.2	4.7	2.5	2	13.9	No[6]
Gamma-Chlordane	2/13	2 - 3.4	PAI-03-SD-54-01	2.2 - 9.6	0.5	6.8	2.7	2.2	2	13.2	No[6]
Inorganics (mg/kg)											
Arsenic	23/23	0.84 - 13.6	PAI-03-SD-44-01	-	7.24	1.9	4.8	4.8	5	12.2	No[6]
Copper	20/20	1.1 - 27.1	PAI-03-SD-44-01	-	18.7	1.4	9.1	9.1	3	10.1	No[6]
Lead	23/23	4.2 - 44.9	PAI-03-SD-60-01	-	30.2	1.5	18.1	18.1	3	20.6	No[6]
Mercury	20/23	0.01 - 0.2	PAI-03-SD-48-01	0.19 - 0.2	0.13	1.5	0.087	0.088	5	0.09	No[6]

Notes:
NA = USEPA Region 4 ecological screening value not available, or background value not available.

1 Site-wide data set consists of all samples collected in 2001 and 2003.
2 Hazard quotient = maximum detected concentration ÷ ecological screening value.
3 Average of detected concentrations, except for total PAHs (see note 7) and total DDT (see note 8).
4 Average concentration of all samples using one-half the detection limit to represent non-detected samples.
5 Background and typical facility pesticide concentrations represent twice the mean concentrations for each analyte detected in background/typical facility pesticide samples (see Appendix D).
6 The decision to retain preliminary COPCs for evaluation beyond Step 3A is a risk management decision; a "yes" or "no" indication here is intended only as a recommendation to risk managers. Furthermore, reasons for retaining or eliminating as final COPCs for Site 3 were based on multiple factors using a weight-of-evidence approach (see Section 6.3.2). Finally, the yes/no recommendations shown in this site-wide data set table are also pertinent to Areas 1-4 and marsh samples when evaluated as separate areas.
7 In samples with at least one detected PAH, total PAHs = the sum of concentrations of 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, dibenzo(a,h)anthracene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene using one-half the detection limit to represent non-detected PAHs.
8 Total DDT = the sum of concentrations of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT isomers using one-half the detection limit to represent non-detected isomers; calculated in samples with at least one detected isomer.